# HANDICAP'S GLOVE

*Project report submitted in partial fulfilment of the requirement for the degree of*

## BACHELOR OF TECHNOLOGY

## IN

## ELECTRONICS AND COMMUNICATION ENGINEERING

BY


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May, 2017

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# DECLARATION BY SCHOLAR

We hereby declare that the work reported in the B-Tech project report entitled "**Handicap's Glove**" submitted at **Jaypee University of Information Technology**, **Waknaghat, India,** is an authentic record of our work carried out under the supervision of **Dr. Rajiv Kumar**. We have not submitted this work elsewhere for any other degree or diploma.


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# SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the B-Tech. project report entitled "**Handicap's Glove**", submitted by **Akhil Singh Thakur, Shubham Sharma at Jaypee University of Information Technology, Waknaghat, India**, is a bonafide record of their original work carried out under my supervision. This work has not been submitted elsewhere for any other degree or diploma.

Dr. Rajiv Kumar

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May, 2017

# ACKNOWLEDGEMENT

We would like to convey our greatest appreciation to all those who rendered us with the big support and opportunities to accomplish this project.

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# ABSTRACT

The imperative role of technology in our daily life has made a significant impact on us. The fruits of growing technology should be shared by everyone. The handicaps are the ones who are left behind. The main issue is the communication gap. This report provides a solution to link the communication gap between handicaps and others. The paper proposes a design of a wearable glove which can be worn by a handicap. The glove will have a touch keypad and vibrational haptic motors. The touch keypad will help in typing the message according to the Braille pattern. This message will be sensed by the handicap because of the vibrations produced by the haptic motors. The motors will vibrate according to the Braille pattern. This will ease the identification of the message by the handicap. Thus, it is an effective and affordable solution for an efficient communication with a handicap and for a handicap.

# CHAPTER 1

# INTRODUCTION

## 1.1 PROBLEM

Technology pervades most of the facet of our lives. To keep up with technology is a necessity. But for the handicaps and visually-impaired it is much more difficult. Communication has grown widely in terms of technological advancement. People with visual impairments and speech impediments find it difficult to communicate with others. Nonetheless, it is also challenging to communicate and understand what is communicated to such handicaps.

According to the recent WHO statistics, it was recorded that about 285 million people are visually impaired among which 39 million are blind [1]. Moreover, they opt for conventional ways of communication such as tactile sign languages, Braille languages, hand movements, lip reading [2]. The disadvantages of these conventional ways of communication are slow and not technologically advanced. Moreover, because of the use of these conservative ways it becomes difficult to use technology for example internet, emails, messaging, etc.

## 1.2 PREVAILING SOLUTIONS

Many works have been done to combat these problems. The Braille keyboard and its analogous have been designed [3]. Researches have been done to make Braille efficient enough to use it along with the computer [4]. Many tactile conversion systems have also been designed which though useful but are cumbersome to operate [5]. Moreover, they are less efficient and slow in their operation.

In addition to all such technologies, a good amount of work has been done to introduce different language to help people understand Braille easily and communicate in their native languages [6], [7]. Nonetheless, different designs were also proposed that can generate text in English by scanning the Braille [8]. Such contributions have helped the handicaps to understand and communicate efficiently. To help them the most, wearable technologies have been introduced. Different Braille gloves have been designed and proposed that can automatically read Braille [9] and help in sensing by using the motors that produce vibrations on the palm and fingers' tip [10].

## 1.3 OUR PROPOSED SOLUTION

A handicap glove is designed in a way that will allow handicap to communicate in both ways from the handicap to other person and vice versa. It includes, Braille which is used in the form of vibrational motors – for handicaps to communicate by receiving message. Moreover, for handicap touch keypad is also installed so that they can communicate back to others. Lastly, an Arduino is installed for processing the information received so as to convert using Braille system to the motors. The uniqueness of this glove is that it will make the handicap to communicate both ways. This means that it can receive and send message from one glove itself.

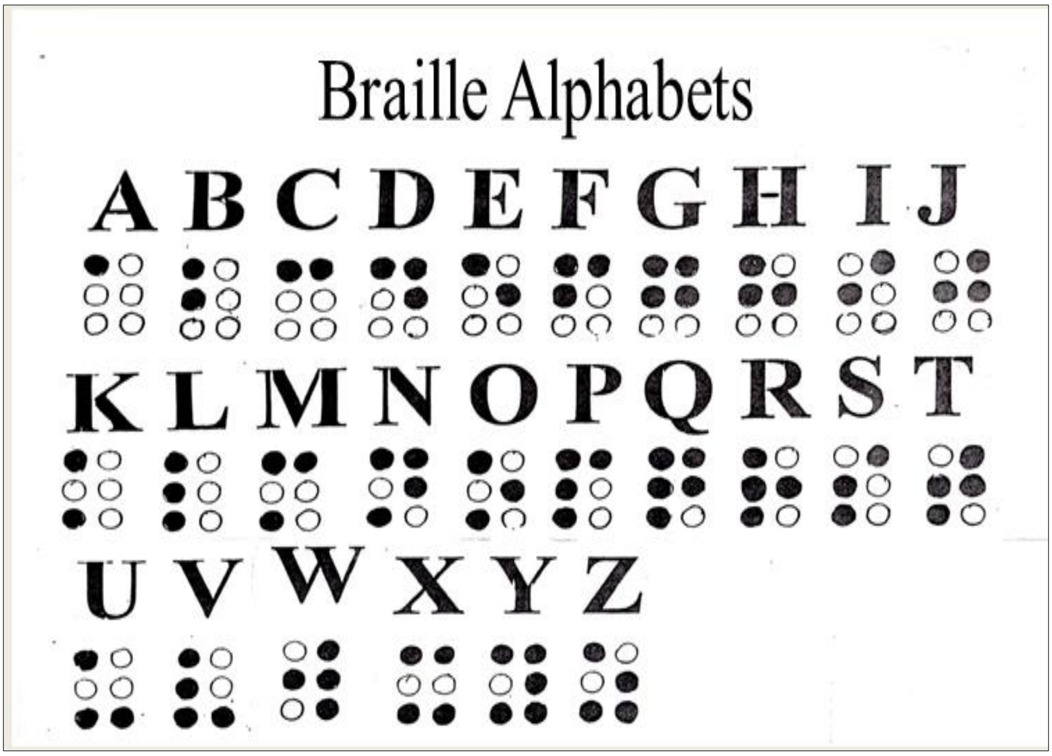


Figure 1.1: Braille Alphabets as devised by Louis Braille

# CHAPTER 2

# DESIGN

## 2.1 COMPONENTS USED

1 Arduino UNO

2 Vibrational Motors

3 Aluminium foil

4 Wires

5 Resistors

6 A Glove

### 2.1.1 ARDUINO UNO

The major component of the project is a microcontroller board, Arduino Uno, which based on the ATmega328 (datasheet). It has fourteen pins, which are digital input and output pins (among those fourteen, six can be utilized as PWM outputs), six analog inputs, a crystal oscillator of 16 MHz, a USB connection, a power jack, an ICSP header and one reset button. It has everything which is required to assist the microcontroller. It can be very easily connected to a computer via USB cable or just power it with the help of a simple AC-to-DC adapter or we can use a battery to get it started. The Arduino Uno is very different from all the other boards because it does not make the use of FTDI USB-to-serial driver chip which is used by the prior boards. It is installed with Atmega8U2 which is programmed as a USB-to-serial converter. Arduino is open-source modeling platform which is based on flexible, easy-to-use hardware and software. It is intended for someone who is involved in creating interactive objects or environments. Or more straight, to read sensors, execute actions based on inputs from buttons, direct motors some codes can be loaded and can further increase its capabilities.

Table 2.1: Arduino specifications

| | |
|---|---|
| Micro-controller | ATmega328P |
| Operating Voltage | 5v |
| Input Voltage (recommended) | 7-12 volts |
| Input Voltage (limit) | 6-20 volts |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| PWM Digital I/O Pins | 6 |
| Analog Input Pins | 6 |
| DC Current per I/O Pins | 20 mA |
| DC Current for 3.3v Pin | 50 mA |
| Flash Memory | 32 KB (ATmega328P)<br>of which 0.5 KB used by bootloader |
| SRAM | 2 KB (ATmega328P) |
| EEPROM | 1 KB (ATmega328P) |
| Clock Speed | 16 MHz |
| Length | 68.6 mm |
| Width | 53.4 mm |
| Weight | 25 g |

POWER:

Power is supplied to Arduino Uno using USB connection or an external power supply. The power source is selected automatically. External power i.e. non-USB, can be provided by using an AC-to-DC adapter or just by using a simple battery. A 2.1mm center-positive is plugged into the power jack of the board to connect the adapter. Leads from battery can be put into the GND and Vin pin headers of the POWER connector. The board can function on an outer supply of 6 volts to 20 volts. If it is supplied with voltage that is less than 7 volts, nevertheless, voltage less than five volts may be supplied by 5V which may make the board unstable. The board may get damaged due to overheating by voltage regulator if more than 12V is used. The recommended range is 7 volts to 12 volts.

The power pins are given below:

1. Vin: It is an input voltage, that is supplied to the Arduino Uno board when it is working on an external source of power (as opposite to five volts coming from the USB connection or from other regulated source of power). Voltage can be provided from this pin, or, if the supplied voltage is via the power jack, then it is accessed from this pin.
2. 5V: The power that is supplied is used to power the microcontroller and other components on the board that requires power supply for their functioning. This can be supplied either by using Vin through an on-board regulator, or by using USB or another regulated supply of 5V.
3. 3V3: An on-board regulator is used to generate a 3.3-volt supply. Maximum current that can be drawn is 50 mA.
4. GND: Two Ground pins are present.


Figure 2.1: Arduino Uno Board

MEMORY:

The Atmega328 has a flash memory of 32 KB for storing code (of which bootloader uses 0.5 KB); it even contains 2 KB of SRAM and an EEPROM of 1KB (which, with the help of EEPROM library, can be read and written).

The Uno has six analog inputs providing a resolution of 10 bits (i.e. 1024 different values) individually. They measure from ground to five volts which is by default, though it is viable to change their range at upper end by using the AREF pin along with the analog Reference() function. Beside this, there are some pins with special functions:

I2C: 4 (SDA) and 5 (SCL):

These pins support the I2C (TWI) communication by using the Wire library.

The board has some other pins also:

AREF – It is the reference voltage for the analog inputs. Used with analog Reference().

Reset - Bring this line LOW which will reset the microcontroller. To add a reset button to shields, it is mostly used.

INPUT AND OUTPUT:

All the fourteen digital pins can be utilized as an input or output pin, on the board, using functions of pin Mode(), digital Read(), and digital Write(). They drive at five volts. Each of the pin can receive or generate a maximum of 40 mA and has a pull-up resistor(which is internal) of 20-50 k Ohms which is disconnected. Apart from this, some pins with special functions are given below:

1. Serial: 0 (RX) and 1 (TX): Used for transmitting (TX) and receiving (RX) TTL (Transistor–transistor logic) serial data. These pins are connected correspondingly to the pins of the ATmega8U2 USB-to-TTL Serial chip.
2. External Interrupts: 2 and 3: To trigger an interrupt on a low value, a falling or rising edge, or a value change, these pins are configured.
3. PWM: 3, 5, 6, 9, 10, and 11: 8-bit PWM (Pulse width modulation) output is provided by this pin, with the analog Write () function.
4. SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK): SPI communication is supported by these pins, which, although the underlying hardware provides, is not included in the Arduino language now-a-days.
5. LED pin 13: The digital pin 13 is connected to a built-in LED. The LED is on when the pin is HIGH value and it's off when the pin is LOW.

PHYSICAL CHARACTERISTICS:

The Uno PCB has a maximum length and width of 2.7 and 2.1 inches respectively, with the power jack and USB connector, it extends beyond the former dimensions. The board can be attached to a surface or case with the help of three screw holes. It is important to note that the digital pins 7 and 8 are 4.064 mm apart, not an even multiple of the 2.54 mm spacing of the other pins.

### 2.1.2 VIBRATIONAL MOTORS

There are basically two types of the vibration motors. The first one is an eccentric rotating mass vibration motor (ERM). A DC motor is used by it which when rotates, creates a force that translates to vibrations. And the second one is linear resonant actuator (LRA). It consists of a small internal mass which is connected to a spring. This spring, when driven creates a force.

Since the 1960s, these tiny vibrational motors have been there around the world. Earlier they were developed as a product for massaging. But in 90's, after their development, these motors took a new turn when consumers demanded vibration-calls on their mobile/cell phones. Vibration alerting is an excellent way to alert users for an event which is been efficiently utilized by the designers in the past two decades in mobile phones.

Now-a-days, in a large range of applications, these vibrational motors are being used by us. Products including tools, medical instruments, GPS trackers, and control sticks, all are using these motors. Vibrating motors are the primary actuators for the haptic feedback, which is quite an inexpensive way by which product's value can be raised and thus differentiates the product from competition.

Figure 2.2: Vibrational Haptic Motor

### 2.1.3 ALUMINIUM FOIL

Aluminium foil has been used in the working of touch-pad. It is the aluminium which is developed in the thin metal leaves which are less than 0.2 mm thick. In the United States, these foils are usually measured in thousandths of an inch. Normally the foils used in the households are having a thickness of about 0.016 mm and the household foils used in heavy duty are about 0.024 mm. These foils are flexible, and can be easily bent or different objects can be wrapped around with them. Thin aluminum foils are very delicate and thus occasionally have to be laminated to other materials like paper or plastics, which makes them more helpful. In between the 20$^{th}$ century tin foils were replaced by these aluminium foils. Aluminium foil has two sides, one is a shiny side and other one is a matte side. The difference of the aluminum foil finish has given rise to the perception that it effects the cooking by favoring one side. While many others wrongly believe that the different properties help in keeping the heat out when the shiny finish is facing out and wrapping is done, but when the wrapping is done with shiny finish facing inwards, it keeps the heat in. Nonetheless, the real difference is unclear without using instruments. Both, emission of radiation and absorption are decreased with an increase in reflectivity. The bright aluminium foil has a reflectivity of 88% while dull embossed foil has an approximate reflectivity of 80%.

Long distance electrical transmissions can be done with the help of aluminum as it conducts electricity efficiently. Other metals share this property with aluminum and it is due to the same reason and the reason is the presence of free electrons. Aluminum has particularly a large amount of electrons in the conduction bands and therefore it is such a good conductor. Being highly conductive is another important characteristic of aluminum.

Figure 2.3: Aluminium Foil Roll

## 2.2 DESIGN

The glove has been designed such that the handicap doesn’t find any difficulty to use it. Arduino is attached to glove in way that it lays on the back side of the hand. Arduino Nano can also be used as a substitute for Arduino, as it is smaller in size and is lighter in weight which makes it easy for the blind to wear and carry along.

The vibrational Braille motors were attached on the glove such that it will be on the wrist so that the handicap can feel the vibration and respond accordingly. The 6 motors were arranged such that there is enough distance between them so that the handicap can feel which motor is vibrating and differentiate between other motor dots, and thus decode the message.

In addition to this, touch keypad was arranged on the palm of the hand. It contains 7 dots to communicate. They were arranged in a way that it doesn’t put weight on the palm of the user. The dots are light in weight and equally spaced according to the Braille so that the user can type fast and he is not confused with other dots.

The wires were embedded within the glove. Thus, it will be very easy for the handicap to use the glove.


Figure 2.4: Proposed design of the glove

### 2.2.1 TOUCH-PAD

The touch-pad is made up of seven dots in total. Among seven dots, six dots are arranged in a way that they will follow the Braille pattern. In order to mark a space between letters or words $7^{th}$ dot has been introduced. These dots consist of two ends, which are tiny open circuits, so if foil or some other conducting materials are touched then it will get short circuited which will basically complete the circuit.

As all these dots are made up of 2 open ends, so one end of a dot is connected to a digital input pin of the Arduino Uno and this input pin is even connected to a resistor, with other end of the resistor being grounded. The other end of the dot which is taken from the Arduino Uno is connected to a 5 volt supply.

After aluminium foil comes in contact with the two ends, the circuit is completed because aluminum is a good conductor of electricity and current flows through it easily. A voltage divider circuit is then completed. All the current flows to the digital input pin through the aluminum foil and it does not go to the ground pin through the resistor. This is because the current follows the least resistant path. The pin to which the current flows becomes logical high. But when the aluminum foil is removed, connection breaks, and it again becomes an open circuit and the current flows from the digital input pin to the ground pin through the resistor.

It becomes logical high when current flows to pin and when the current do not flow to pin it remains logical low. This process takes place in all the dots of the touch-pad. So, whenever dots are touched with the aluminum foil, they become logical high and otherwise they stay logical low.

Hence, touching the dots of touch-pad with aluminum foil, according to the Braille pattern will produce the desired alphabets with the help of Arduino Uno.

Following diagram shows the circuit which has been employed in all the 7 dots of the touch-pad.

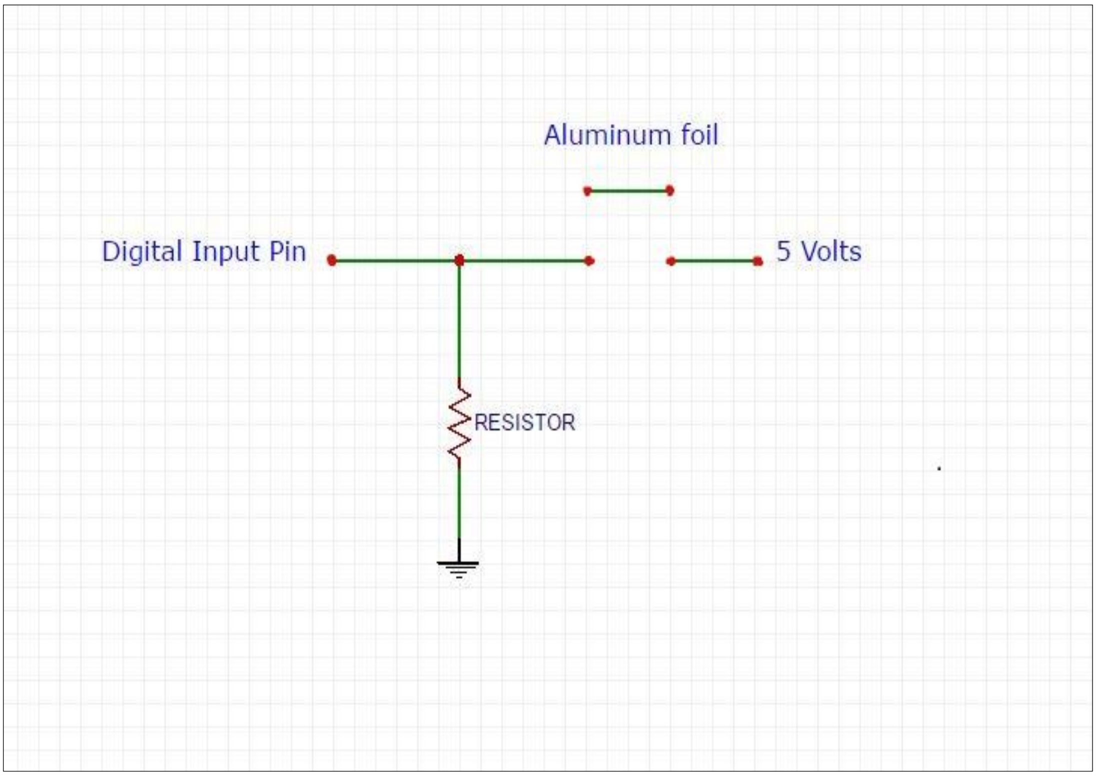


Figure 2.5: Circuit used for a dot in touch-pad

5 volts supply has been taken from the Arduino and the resistor has been grounded in the Arduino GND pin.

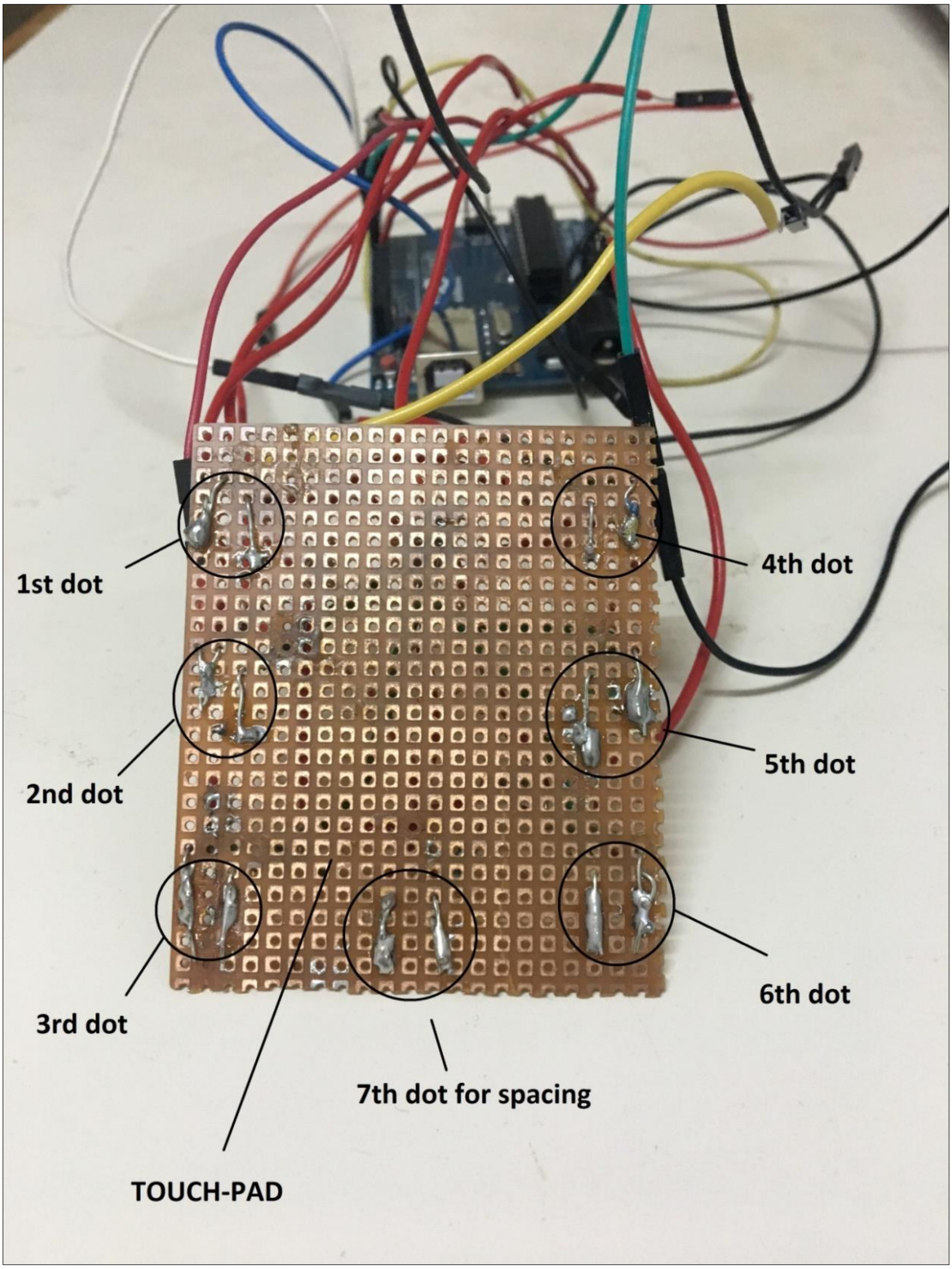


Figure 2.6: Touch-pad

### 2.2.2 ARRANGEMENT OF VIBRATIONAL MOTORS

A Braille pattern is made up of raised dots which are arranged in a cell and a cell is made up of 6 dots, arranged in 2 columns of 3 dots each.

Similarly, in the handicap's glove 6 vibrational motors have been placed in 2 columns of 3 motors each, like the raised dots of a cell. This cell of 6 motors has been placed on the wrist area of the glove. When these motors vibrate together, they form a Braille pattern. These patterns of vibrating motors can be sensed by the user and will help him to understand the alphabets, thereby helping the user to understand the whole message easily.

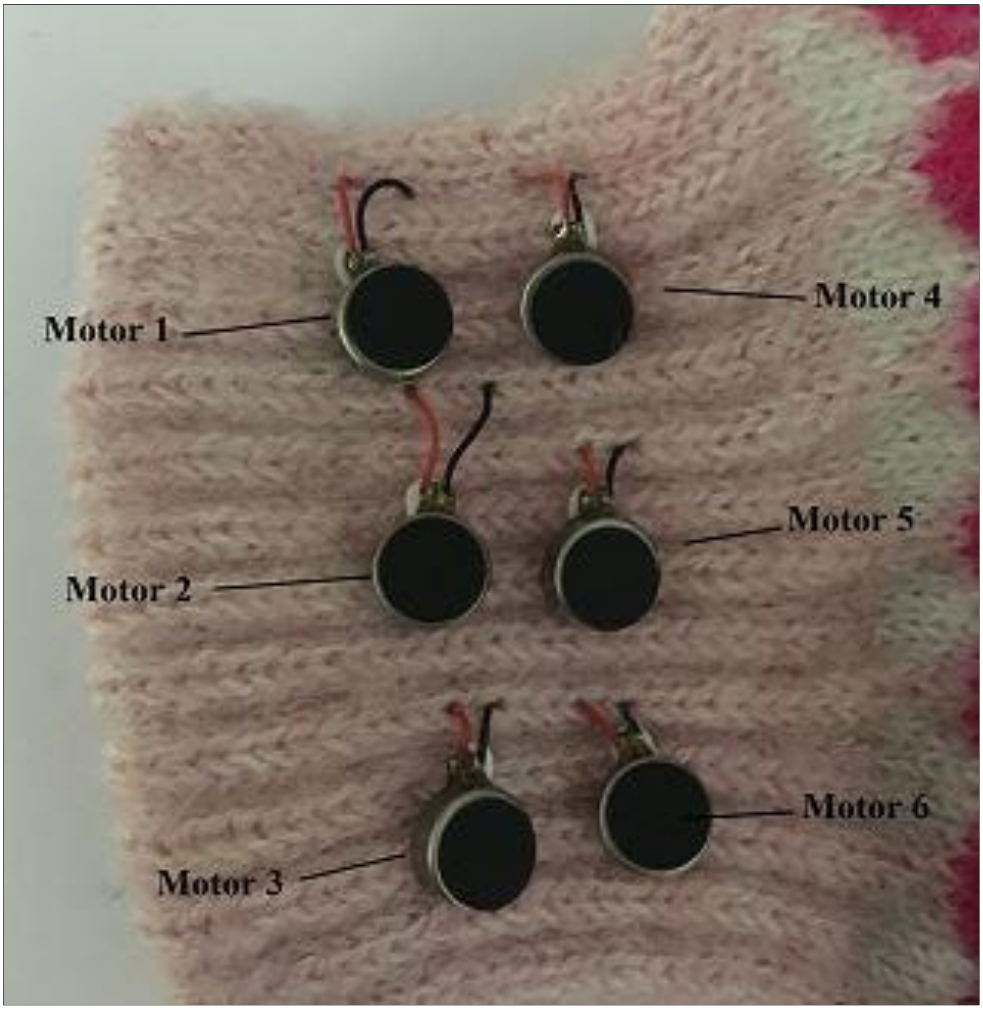


Figure 2.7: Arrangement of motors

All these 6 motors have been connected to the Arduino Uno. When a person will communicate a message, the data will be received by the micro-controller and the data will be processed by it. After processing the data, these motors vibrate according to the message, in a way that conforms to the Braille pattern.

For example, if only the motor 1 is vibrating, it conforms to the Braille pattern of alphabet ‘a’. The user will easily understand and decode that the message is the alphabet ‘a’. Similarly, if motors 1 and 2 are vibrating, it conforms to the Braille pattern of alphabet ‘b’. The user will understand that the message is alphabet ‘b’. Hence, it will be very convenient for the user to understand the message just by sensing the vibrations of the vibrational motors.

# CHAPTER 3

# METHODOLOGY

The proposed solution for an enhanced communication is as such to make it effective and easy to use. The visually impaired person will wear the glove for the communication. Firstly, if the handicap wants to communicate with other person, he will use the touch keypad which will be constituted of the Braille dots. With the help of these Braille dots he or she can write a sentence. Nonetheless, for putting space between two words we have put an extra Braille dot. So, in total there are 6+1 =7 Braille dots for the communication.

The other way communication will be done with the help of vibrational motors. If a person wants to interact with the handicap person he will communicate a message and the vibrational motors will vibrate according to the message. It will extract each letter from the sentence sent to the handicap. The vibrational motors will vibrate in accordance with the letter sent, conforming to the Braille language.

As the touch and feel sense is higher in blind as compared to people with normal sight, it will be easy for them to sense the vibration in the Braille pattern. Thus, when the vibrational haptic motors vibrate according to the Braille language, they will able to sense the vibration easier and get to know the message sent by the sender and so respond accordingly.

Figure 3.1 explains the working of the proposed design of the handicap's glove. In nutshell, person 1 will communicate a message. This message will be received by the device. Then data processing will be done by the microcontroller which is the Arduino. Then vibrational Braille haptic motors will vibrate accordingly. Then the user or the person 2 will understand the message. The person 2 will communicate back with the help of the touch-pad.

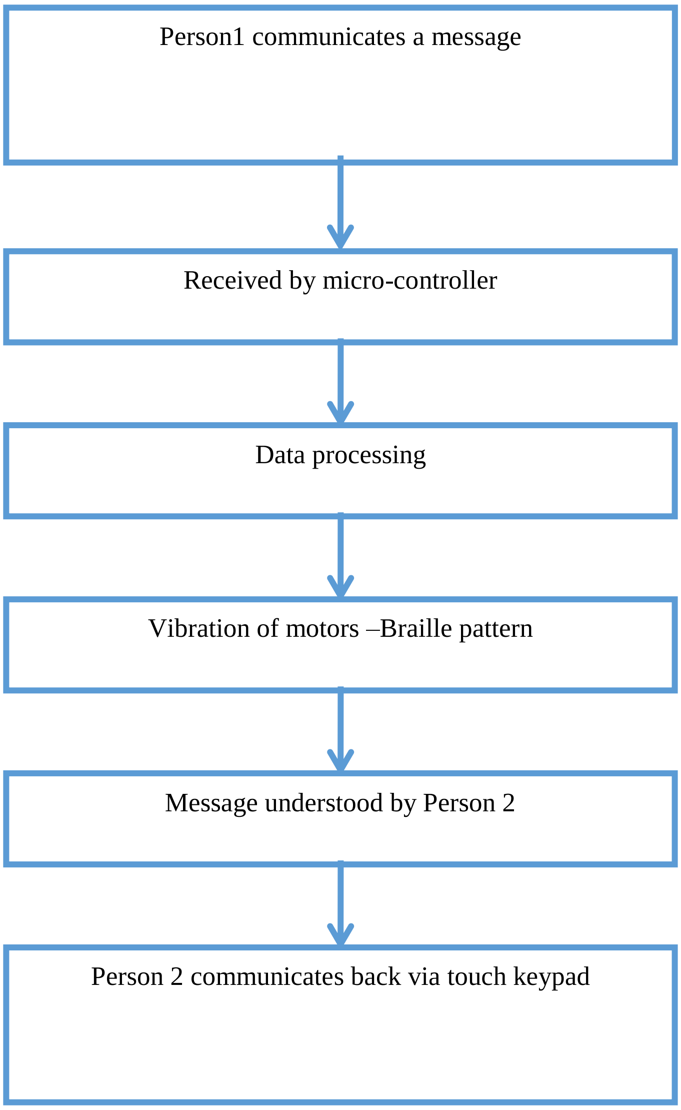


Figure 3.1: Working of the glove

# CHAPTER 4

# RESULTS

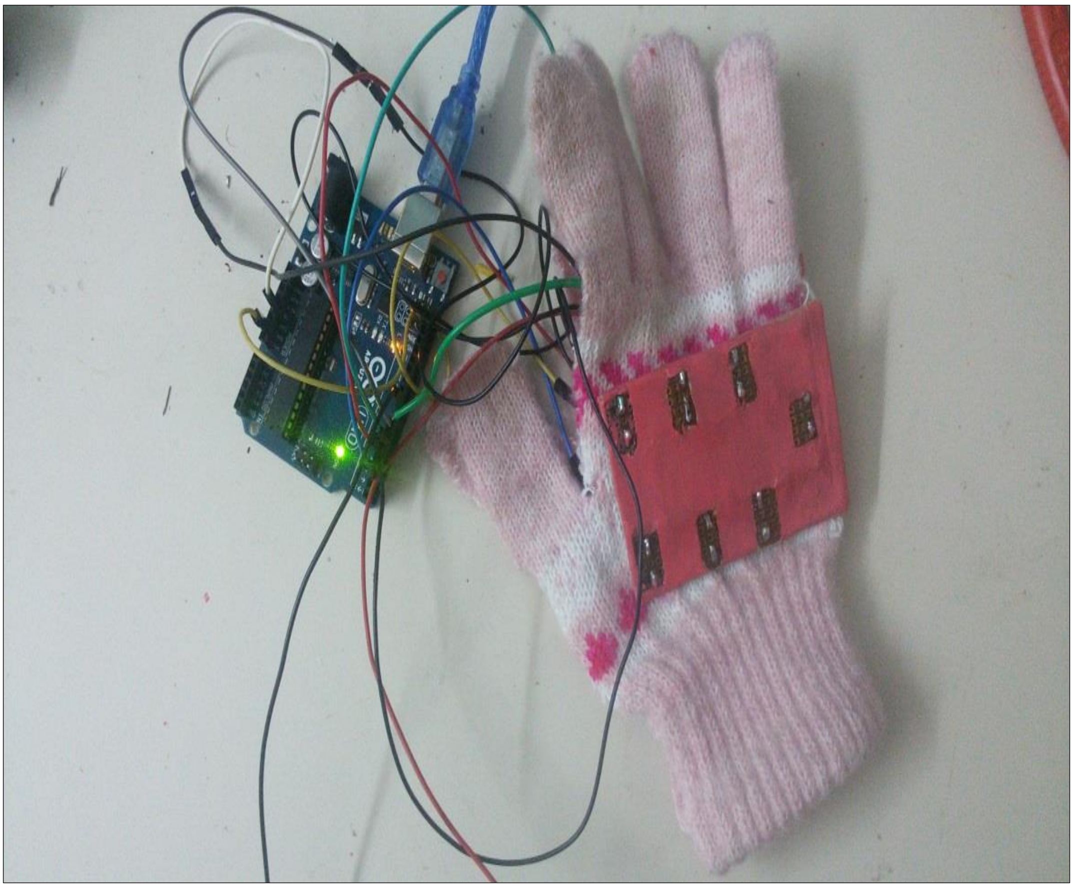

Figure 4.1: The implemented design of the glove (front)

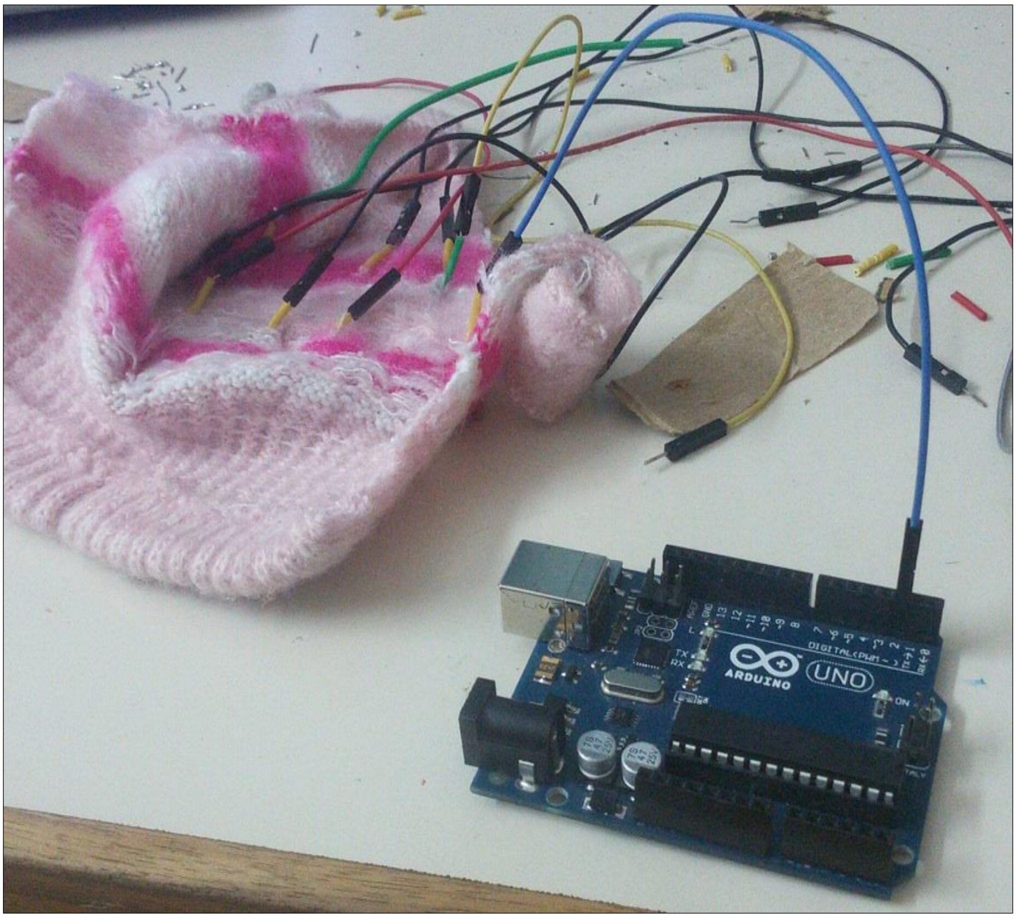


Figure 4.2: The implemented design of the glove (inside)

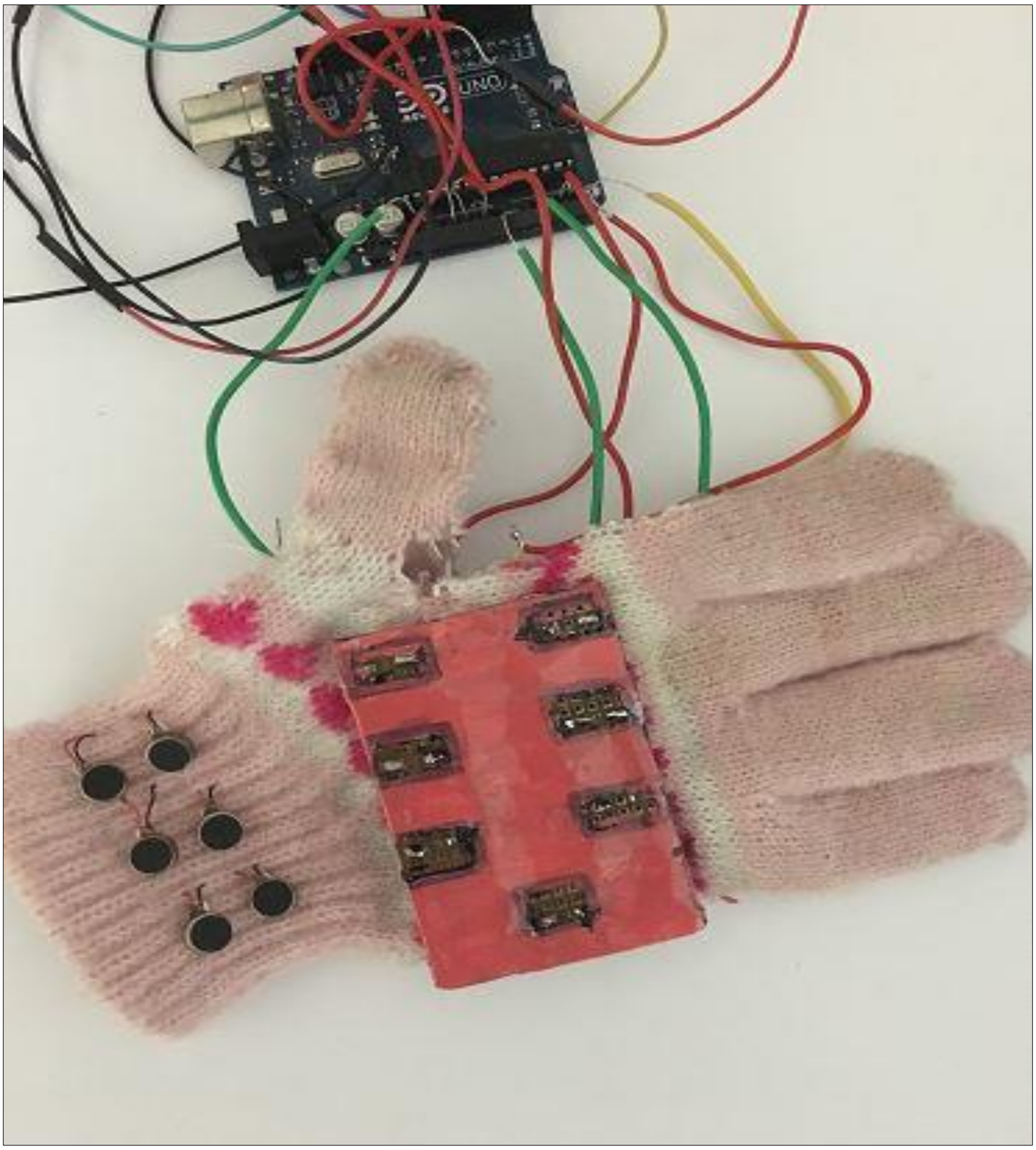


Figure 4.3: The implemented design of the glove (alongwith vibrational motors)


Figure 4.4: Alphabets typed with Touch-Pad


Figure 4.5: Message typed with Touch-Pad

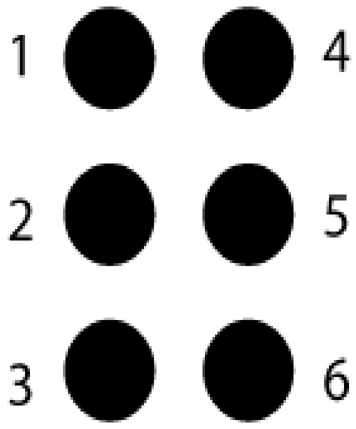


Figure 4.6: Vibrational motors and their numbers

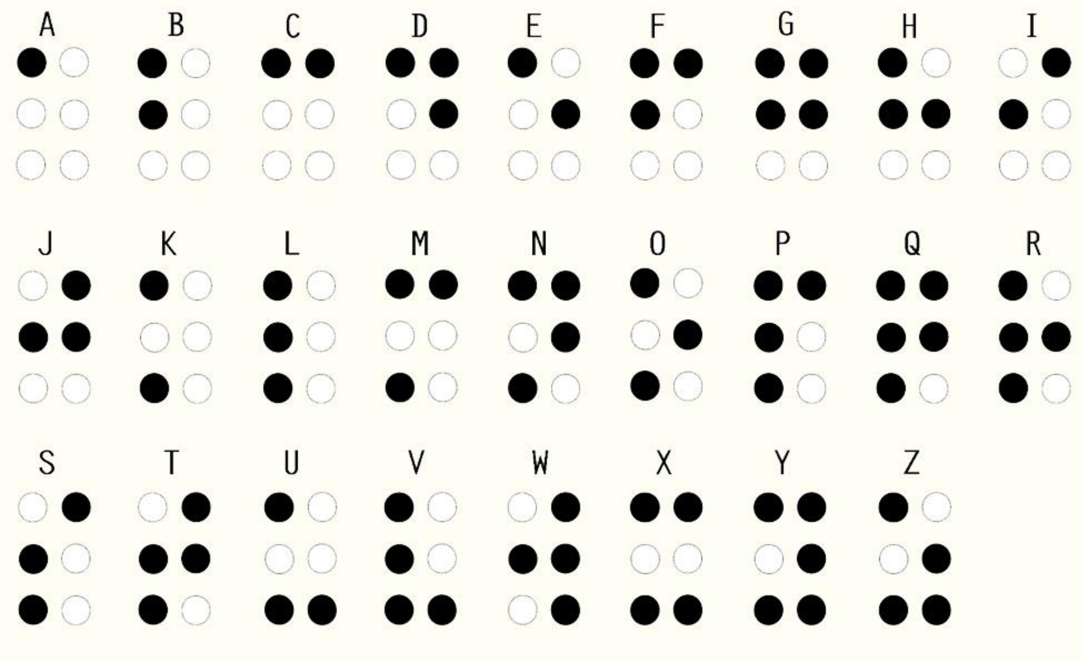


Figure 4.7: All 6 vibrational motors placed, where the black dots represent the motors vibrating. The motors will vibrate together according to the Braille pattern of alphabets.

Table 4.1: Results from vibrational motors

| S. no. | Input Alphabet | Motors Vibrating (their numbers) |
|---|---|---|
| 1 | A | 1 |
| 2 | C | 1,4 |
| 3 | D | 1,4,5 |
| 4 | G | 1,2,4,5 |
| 5 | M | 1,3,4 |
| 6 | N | 1,3,4,5 |
| 7 | Q | 1,2,3,4,5 |
| 8 | V | 1,2,3,6 |
| 9 | X | 1,3,4,6 |
| 10 | Z | 1,3,5,6 |

# CHAPTER 5

# CONCLUSION & FUTUREWORK

A model is proposed which will be helpful for handicaps to communicate effectively and easily. The user will be able to communicate with one another in both the ways with the help of the glove. They will also be able to type the message with the inclusion of the touch keypad. Moreover, it will also read or feel the message with the help of vibrational motors that are installed in the glove that is incoming from another person. The glove is light in weight and the motor dots and touch-pad dots are spaced according to the Braille.

The glove is designed so that no handicaps are left behind the technology. The fruit should be equally enjoyed. As it is also challenging to communicate back, with this proposed design it will also be easy to do that. Moreover, the design is proposed by keeping in mind the affordability. The components used in this design are very low in cost. Thus cost would not increase beyond 600-700 INR, making it an affordable one. All the old and orthodox ways of communication are generally slow and inefficient and requires the other person to know the language or signs they are using to communicate. With the help of this, the message will be translated from Braille language to English or any other preferred language. Thus, any person not knowing the language can also communicate competently.

The design proposed here can be made according to the user. An application can be created so that the communication can take place through mobile phones, using Bluetooth modules or an application for multiple users to communicate. Database can be made where the messages can be stored and when the user wants to read, the messages can be read one by one. Moreover, this handicap’s glove can also be used as a safety device. Those who cannot speak or find difficulty in speaking, can also communicate and alert others about their situation. If they need any medical help, a button can be attached with the glove so that the other person is alarmed and can help him out.

Furthermore the range can be increased by using a Wi-Fi module so that the Handicap can talk to people at longer ranges and distances. This cannot be overcome by either tactile sign languages or Braille reading. Thus the proposed design is an effective and a smart solution for enhancing the communication for Handicaps.

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# APPENDIX

## IMPLEMENTATION CODE FOR TOUCH-PAD

The code is set up in Arduino IDE. The code is as follows:

```
void setup() {
  // declare the ledPin as an OUTPUT:
  pinMode(2, INPUT);
  pinMode(3, INPUT);
  pinMode(4, INPUT);
  pinMode(5, INPUT);
  pinMode(6, INPUT);
  pinMode(7, INPUT);
  pinMode(8, INPUT);
  Serial.begin(9600);
 }
void loop()
{
 // digitalWrite(sensorPin, LOW);
 int value1 = digitalRead(2);
 int value2 = digitalRead(3);
```

```
 int value3 = digitalRead(4);
 int value4 = digitalRead(5);
 int value5 = digitalRead(6);
 int value6 = digitalRead(7);
 int value7 = digitalRead(8);
 if(value1 == HIGH && value2 == LOW && value3 == LOW && value4 == LOW
&& value5 == LOW && value6 == LOW)
{
Serial.print("A");
delay(1000);
}
else if(value1 == HIGH && value3 == HIGH && value2 == LOW && value4 ==
LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("B");
 delay(1000);
 }
else if(value1 == HIGH && value2 == HIGH && value3 == LOW && value4 ==
LOW && value5 == LOW && value6 == LOW)
 {
```

```
  Serial.print("C");
  delay(1000);
}
else if(value1 == HIGH && value2 == HIGH && value4 == HIGH && value3 == LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("D");
  delay(1000);
 }
 else if(value1 == HIGH && value4 == HIGH && value2 == LOW && value3 == LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("E");
  delay(1000);
 }
 else if(value1 == HIGH && value2 == HIGH && value3 == HIGH && value4 == LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("F");
  delay(1000);
```

```
}
 else if(value1 == HIGH && value2 == HIGH && value3 == HIGH && value4 ==
HIGH && value5 == LOW && value6 == LOW)
 {
  Serial.print("G");
  delay(1000);
}
 else if(value1 == HIGH && value3 == HIGH && value4 == HIGH && value2 ==
LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("H");
  delay(1000);
}
 else if(value2 == HIGH && value3 == HIGH && value1 == LOW && value4 ==
LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("I");
  delay(1000);
}
```

```
 else if(value2 == HIGH && value3 == HIGH && value4 == HIGH && value1 == LOW && value5 == LOW && value6 == LOW)
 {
  Serial.print("J");
  delay(1000);
}
 else if(value1 == HIGH && value5 == HIGH && value2 == LOW && value3 == LOW && value4 == LOW && value6 == LOW)
 {
  Serial.print("K");
  delay(1000);
}
 else if(value1 == HIGH && value3 == HIGH && value5 == HIGH && value2 == LOW && value4 == LOW && value6 == LOW)
 {
  Serial.print("L");
  delay(1000);
}
 else if(value1 == HIGH && value2 == HIGH && value5 == HIGH && value3 == LOW && value4 == LOW && value6 == LOW)
```

```
{
 Serial.print("M");
 delay(1000);
}
else if(value1 == HIGH && value2 == HIGH && value4 == HIGH && value5 == HIGH && value3 == LOW && value6 == LOW)
{
 Serial.print("N");
 delay(1000);
}
else if(value1 == HIGH && value4 == HIGH && value5 == HIGH && value2 == LOW && value3 == LOW && value6 == LOW)
{
 Serial.print("O");
 delay(1000);
}
else if(value1 == HIGH && value2 == HIGH && value3 == HIGH && value5 == HIGH && value4 == LOW && value6 == LOW)
{
 Serial.print("P");
```

```
 delay(1000);
}
else if(value1 == HIGH && value2 == HIGH && value3 == HIGH && value4 == HIGH && value5 == HIGH && value6 == LOW)
{
 Serial.print("Q");
 delay(1000);
}
else if(value1 == HIGH && value3 == HIGH && value4 == HIGH && value5 == HIGH && value2 == LOW && value6 == LOW)
{
 Serial.print("R");
 delay(1000);
}
else if(value2 == HIGH && value3 == HIGH && value5 == HIGH && value1 == LOW && value4 == LOW && value6 == LOW)
{
 Serial.print("S");
 delay(1000);
}
```

```
else if(value2 == HIGH && value3 == HIGH && value4 == HIGH && value5 == HIGH && value1 == LOW && value6 == LOW)
 {
  Serial.print("T");
  delay(1000);
 }
else if(value1 == HIGH && value5 == HIGH && value6 == HIGH && value2 == LOW && value3 == LOW && value4 == LOW)
 {
  Serial.print("U");
  delay(1000);
 }
else if(value1 == HIGH && value3 == HIGH && value5 == HIGH && value6 == HIGH && value2 == LOW && value4 == LOW)
 {
  Serial.print("V");
  delay(1000);
 }
else if(value2 == HIGH && value3 == HIGH && value4 == HIGH && value6 == HIGH && value1 == LOW && value5 == LOW)
```

```
 {
  Serial.print("W");
  delay(1000);
 }
else if(value1 == HIGH && value2 == HIGH && value5 == HIGH && value6 == HIGH && value3 == LOW && value4 == LOW)
 {
  Serial.print("X");
  delay(1000);
 }
else if(value1 == HIGH && value2 == HIGH && value4 == HIGH && value5 == HIGH && value6 == HIGH && value3 == LOW)
 {
  Serial.print("Y");
  delay(1000);
 }
else if(value1 == HIGH && value4 == HIGH && value5 == HIGH && value6 == HIGH && value2 == LOW && value3 == LOW)
 {
  Serial.print("Z");
```

```
  delay(1000);

 }

else if(value7 == HIGH)

{

  Serial.print(" ");

  delay(1000);

  }

}
```