A SMART BAND VOICE BASED TEXT TO BRAILLE CONVERSION FOR VISUALLY IMPAIRED PEOPLE

W. Godfrey Daniel[1], K.K. Saravanan[2*], T. Naresh[3]

[1]Assistant Professor, Department of Instrumentation and Control Engineering, Sri Manakula Vinayagar Engineering College, Puducherry
[2]Assistant Professor, Department of Electrical and Electronics Engineering, University College of Engineering Thirukkuvalai, Thirukkuvalai
[3]UG Student, Department of Instrumentation and Control Engineering, Sri Manakula Vinayagar Engineering College, Puducherry

Abstract:

People with "blindness" and "Deafness-blindness" are often isolated and forced to live in a limited world, as they face serious compound communication problems. This project introduces a system to support the communication of blind and deaf-blind people, thus fostering their independence and integration in the society. This project uses small and cheap components to build a communication device that solves the previously mentioned problems. It includes a Smart-Band that translates the braille alphabet, which is "a system of raised dots that can be read with finger sensation by blind and vision impairment people all over the world in their native languages. The Smart-Band enables the blind and deaf-blind user to create a text message by pressing properly ordered push button switches located on a Smart-Band. The message is then transmitted by Bluetooth to the other mobile user. The Smart- Band can also receive incoming messages using small vibration motors located on the back of the band, which allows the blind to perceive the alphabets. An important advantage of the system is that it does not require people to have knowledge of braille in order to interact with the blind person.

Keyword: *Bluetooth, Vibration motors, Braille alphabet.*

INTRODUCTION

According to world health organization (WHO), it has been estimated that 39 million people are blind worldwide, and 285 million people are visually impaired. Many developing countries including Palestine have limited facilities for those people, for that they are living isolated with no education and employment as they and their families are afraid to face and communicate with the world. Globally, braille is the way that those people communicate with, and it is a system of raised dots which are formed by six dots that can be read by fingers sensation, and it is used by millions of people around the world in their native languages. This method proved its affectivity. However, the problem lies in that most people do not understand the braille. In developing countries, limited technologies are available to serve these people. With our little materials we came with this project, designing a Smart-Band that enable deaf-blind, blind and low vision people to receive and send text messages. The common way of writing and reading for many people with severe visual impairment and blindness is through braille system. While these persons can read and write using the braille system, the majority of normal persons cannot, and thus there exists communication barrier between seeing and blind people. The most important motivations for the project are to overcome this communication barrier. The Smart-Band developed in this project provides the ability to blind person who use braille system to send and receive a text message. This achieves several points, the most importance point is to enable the blind person to communicate with other people in an easier way, also to overcome the difficulty of communication in school between the blind and deaf-blind with their teachers and other students, or even solve the problems that can face them at work. At the present, message exchange is becoming one of the most important social communication media. Braille is a well–established "system" for communicating with blind people. However, most people do not understand braille. The design of the Smart-Band, presented in this project, will support the blind and deaf-blind person's involvement in the society by converting braille characters into written text characters and vice versa. In this way, the communication problem between blind and deaf-blind persons and other people is efficiently solved. This project is mainly designed to help blind and deaf-blind people communicate with other people.

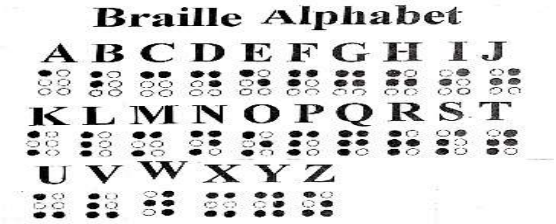

Fig 1: Braille Alphabet

We will design a Smart-Band which translates the braille alphabet into text and vice versa. The Smart-Band has a set of pushbutton switches. Blind user can write messages through pressing pushbuttons located on the Smart-Band. Hence different Pushbutton patterns correspond to different braille codes. These braille codes are sent by Bluetooth to the mobile, where they are converted to display the corresponding alphabets, words and sentences. If user receives a message from the mobile, then the character corresponds to a braille code which is matched to the six vibration motors on the braille hand Smart- Band. Hence, the vibration motors corresponding to the braille code of the particular character vibrates and the character is read efficiently by the reader.

EXISTING SYSTEM

1.Pi Cam: IoT based Wireless Alert System for Deaf and Hard of Hearing

The objective of this paper is to design and implement a low-cost stand-alone device for deaf people to notify doorbell ringing who live alone in their house. The system is based on Raspberry pi which includes camera, vibrator, wireless GSM, and Bluetooth. When the visitor presses the door bell, captured image is transferred to the wearable device which helps to know the right persona the door or intruder. After transferring image, wearable device vibrates to notify. Also, the message is sent to the owner through GSM. Visitor's image along with the date and time is sent to the server for retrieving information later. The system is reliable, effective, and easy to use and enhances the security of the user.

2.Design of a communication aid for physically challenged

The proposed work in this paper is to implemental system without handheld gloves and sensors and by capturing the gestures continuously and converting them to voice and vice versa, thus making the communications impler for Deaf and dumb people by hand held embedded device along with the hard ware setup. The effectiveness of the work was verified under MATLAB environment and further in future dedicated voice output will be produced corresponding to the text and the gesture images captured.

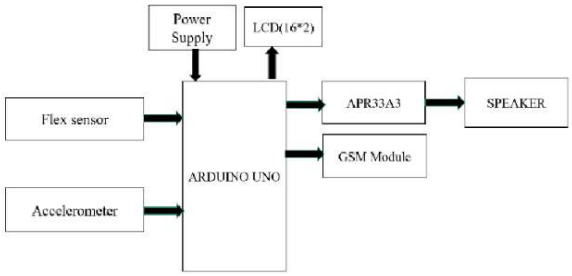

Fig 2: Block Diagram

The block diagram of speaking system for mute people using hand gestures is as shown. The system has both hardware and software. Hardware part includes flex sensors, Arduino, LCD display, GSM module. Software includes the programming of Arduino according to the gestures. In this system flex sensors are

placed on gloves according to the gesture made by the user the resistance values will change, and sensor produces voltage. The output voltage of flex sensors is processed using Arduino Mega2560. Predefined threshold values for each gesture and its corresponding messages are stored in the database of the microcontroller. When the input voltage of the microcontroller exceeds the threshold value, LCD displays the message that was assigned to the gesture in the database and the speech signal is produced using APR33A3 through speaker (English and Kannada) in our system. Flex sensors are placed on gloves which can be easily operated by the user by making gestures. According to the gesture made by the user the resistance values will change, and sensor produces voltage correspondingly. The output voltage of flex sensors is in the analog form which is converted into digital form by using inbuilt ADC of at mega 328. Predefined gestures with corresponding messages are stored in the database of the microcontroller in different languages. Microcontroller matches the motion with the database and produces the speech signal using APR (Auto Playback Recorder). The output is given out through the speaker and GSM module is used to send text messages. In this project work, the sign language will be more helpful for the ease of communication between the mute people and normal people. The project mainly aims at reducing the gap of communication between the mute people and normal people. Here the methodology intercepts the mute signs into speech. In this system it overcomes the difficulties faced by mute people and helps them in improving their manner. The projected system is very easy to carry to any places when compared to existing systems. To help the mute people, the language gets converted into text kind and on the digital display screen it will be displayed. Who cannot communicate with normal people i.e., deaf, and dumb people the system is very much helpful. The primary feature of the project is the one which will be applied in common places that the recognizer of the gestures may be a standalone system.

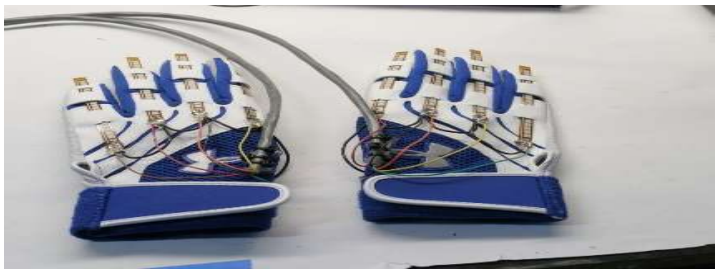

Fig 3: Flex Sensor Gloves

A Smart Speaking Glove for Speech impaired People is designed and implemented with four gestures. Each gesture specifies basic needs such as “NEED WATER”, “NEED MEDICINE”, “NEED FOOD”. This system is more reliable, efficient, easy to use and a lightweight solution to the user as compared to other proposed systems. This bridges the communication gap between speech impaired people and others. During this project we have faced various challenges and we have tried to minimize the problem. Since we observed that they cannot handle bulky and delicate in structure. We have minimized the communication problem as: The output is in the form of speech which is easily understood by others. This system will help the speechless people to express their needs using gestures. The voice output can be manipulated in any language according to the user.

3.Design of Smart e-Tongue for the Physically Challenged people

Here they designed a system which converts their sign symbol to text as well as voice output and normal person’s voice to corresponding sign symbol for two-way communication. This system has flex sensor and IMU (Inertial Measurement Unit) to recognize their sign symbol, speech synthesis chip for voice output and speech recognizing module for converting voice to sign symbol. These are interfaced with microcontroller, which is programmed to obtain corresponding output.

PROPOSED METHOD

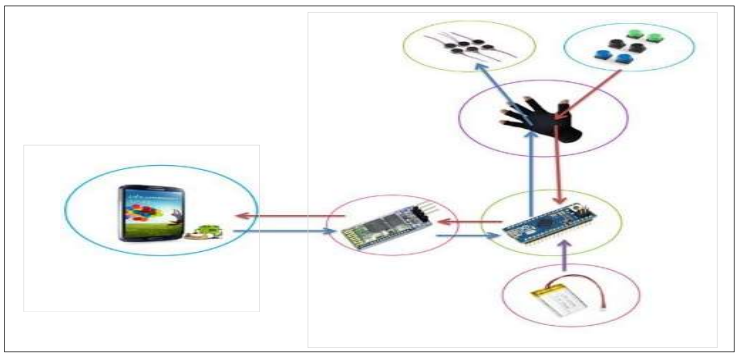

Fig 4: Smart Band Design

The Smart-Band design shown in Fig 4 illustrates the detailed description of the project connections and components. Smart-Band contains pushbutton switches and vibration motors located on soles and back of the band. These are connected with the Arduino controller, which enables blind user to write, send and receive braille messages. The Bluetooth module, located on the band, established the connection between the two system parts. Furthermore, mobile user can write and receive text messages from and to Smart-Band user using the same connection. Follow the arrows track to see the path of the messages on each time. The blue arrows show the process of sending message from mobile application to Smart-Band (vibration motors), and the red arrows show the process of sending message from the Smart-Band (push buttons) to the mobile.

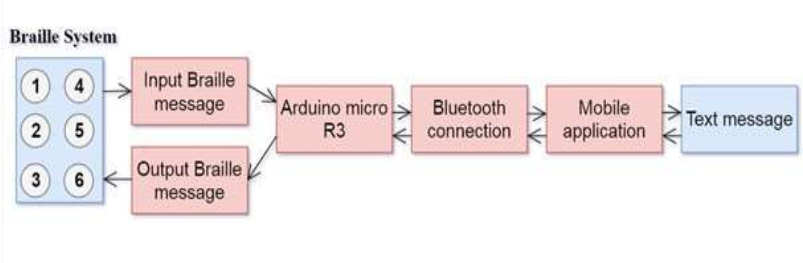

Fig 5: Block Diagram of Smart Gloves

The block diagram in Fig 5 shows how the system works in both directions. Braille system box here represents pushbuttons and vibration motors each time according to the direction of messages. In the first way (from left to right), the blind enters a braille message by pressing pushbuttons. Pushbuttons readings will be transformed to Arduino. The Arduino should receive these readings as data form and send signals to the mobile application using Bluetooth connection, then the message will display as a text message on the mobile screen. In the other way (from right to left), the text message, which is written in mobile application, will be transformed as data form by Bluetooth connection to Arduino. The Arduino should receive data and send signals as an output braille message to the vibration motors. This is done by actuating vibration motors for every received character.

Based on previous Figures 3 and 4, the usage of the system is illustrated in the following points:

1. Start by activation the Arduino by connects it with the Buttery.
2. Turn on the mobile and activation the android application.
3. Check the Bluetooth connection. If there is no Bluetooth connection an attention message will appear to a mobile user telling him to try reconnect by select the Bluetooth name to make a pair. If there is Bluetooth connection then the application is ready.
4. Mobile user can write a text message in the application and send it to the Smart- Band (blind) user. The message will receive to the Arduino and then the vibration motors will vibrate for every

received character "vibration representing the braille characters".

5. The Smart-Band (blind) user can write a braille message and send it to the mobile user. Then the mobile user will receive a text message shows on his mobile screen.

Build an Android application using Android Studio program through Android language. The function of the application is to send and receive text messages from and to Smart-Band. The normal user uses the application to send and receive text messages from and to blind user who wear a Smart-Band. The application must support these processes:

1. Make a Bluetooth connection.
2. Write and send a text message.
3. Receive a text message.
4. Supports audio-to-text conversion.

In addition, the application contains many activities as Home page, practice, speech, setting and Bluetooth connection. The Figure below shows the main interface of application. The interface of the application is very simple and user friendly so that it may not take any time to learn the features in the application.

Fig 6: Smart-Band application

Starting with **Arduino micro R3**, we successively make connect the other system components as follows:

1.We connect Arduino micro R3 with **Bluetooth Module HC-05**, to receive and send signals.

2.We connect Arduino micro R3 with **vibration motors** using analog pins in the microcontroller, that we can control the vibration degree of each motor.

Result:

The vibration motors vibrate to enables the blind user to feel the vibrating of each point of vibration motors located on the Smart-Band**.**

3.We connect Arduino micro R3 with six **pushbuttons** located in the Smart-Band using digital pins, which represents a braille printer. We used another two pushbuttons to send the message from the Smart-Band to mobile application, first one to send the character and the second button to send the complete message.

Result:

We write a message using braille by press the buttons in a particular pattern according the braille system and send it to the application which receives it as a text message.

4.We used two Lithium (Lipo) batteries each one is 3.7v to power the Arduino micro R3, we

welded USB link with it to connect with Arduino and charge the battery.

Finally, we install the microcontroller circuit is described above on **Smart-Band** as follows:

- We installed six vibration motors, which represent the six dots in braille system on the back of the band.
- We installed the six pushbuttons, which represent the six dots in braille system and two sending buttons below the six buttons on the palm of the band.
- We installed the Bluetooth on the band.
- Installed the Arduino micro R3 on the wrist and connect all components (vibration motors, pushbuttons, Bluetooth) with
- micro pins.

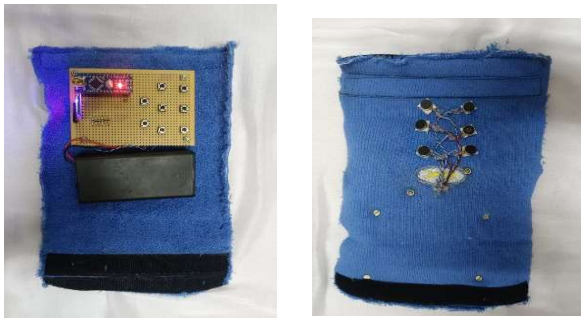

Fig 7: Smart Band Gloves

CONCLUTION

In this paper, we constructed a Smart-Band for supporting blind and deaf-blind people in communicating with normal people that are not familiar with braille. The Smart-Band is able to connect to Android mobile and facilitate exchange of messages. Whereas the android application is able to send and receive text messages from and to the Smart-Band and the Smart-Band able to send and receive braille messages from and to the application. The Smart-Band is light, cheap, easy to use and no risk. At the end of the project we believe that the project is an effective and very useful for blind people to communicate with others, and it is very useful for deaf-blind people if they are taught braille where they can communicate with their families and people around them. We faced some issues and problems while working on the project. The first issue faced that there is no deaf-blind person in the associations and schools in Palestine Know braille system or another language. We faced other issues while working on the components of project due to the small size of the pieces and difficulty welding. Ultimately, with this project, we aim at supporting the largest number of blind people and blind schools. To achieve this, several features can be improved. Mainly the system should be extended to support other languages, and the system can use several ways to communicate, it can use Wi-Fi connection, which enables a faster connection and better range from anywhere in the world.

REFERENCE

1. (BrailleBand: Blind Support Haptic Wearable Band for Communication using Braille Language, 2017)Your Bibliography: BrailleBand: Blind Support Haptic Wearable Band for Communication using Braille Language. (2017). [image].
2. Arduino – Environment. Retrieved November 31, 2017, from https://www.arduino.cc/en/Guide/Environment
3. Bandodkar, M., &Chourasia, V. (2014). Low cost real-time communication braille hand-band for visually impaired using slot sensors and vibration motors. Int. J. Electr. Comput. Energ. Electron. Commun. Eng/(accessed October 31, 2017)
4. Florida Vision Technology (2016). Braille Sense U2. [image] Available at: http://www.floridareading.com/braille-sense-u2.html [Accessed 31 Oct. 2017]
5. Free Assessment Service.Retrieved October 31, 2017, from https://www.quantumrlv.com.au/jot-a-dot.html/
6. Fully Integrated Hall Effect Motor Driver for Brushless DC Vibration Motor Applications. (2017). [ebook] Shaun

Milano, p.2. Available at: http://www.allegromicro.com/en/Design-Center/Technical-Documents/Hall-Effect-

7. Sensor-IC-Publications/Fully-Integrated-Hall-Effect-Motor-Driver-for-Brushless-DC-Vibration-Motor-Applications.aspx [Accessed 1 Dec. 2017]
8. GES Networking. Retrieved October31,2017, from https://gesnetworking.globalinnovationexchange.org/ user/ amaniabutairgmailcom/
9. Murray, I., & Pasquale, A. (2006, October). A portable device for the translation of braille to text. In Proceedings of the 8th international ACM SIGACCESS conference on Computers and accessibility. ACM/(accessed October 27, 2017).
10. Phillips, J. Braille Writer. [image] Available at: http://louisbrailleschool.org/resources/writing-braille/braille-writer/ [Accessed 31 Oct. 2017]
11. Savindu, H. P., Iroshan, K. A., Panangala, C. D., & Perera WLDWP, D. S. A. BrailleBand: Blind Support Haptic Wearable Band for Communication using Braille Language/(accessed October 31, 2017)
12. Vision impairment and blindness. Retrieved October 27, 2017, from http://www.who.int/ mediacentre/ factsheets/fs282/en/
13. What Is Braille. Retrieved October 27, 2017, from http://www.afb.org/info/living-with-vision-loss/braille/what-is-braille/123