BRAILLE BASED COMMUNICATION GLOVES

[1]Aishwarya Anil, [2]Jyothi Biju, [3]Anjani S,[4]Donymon Jomon,[5]Juney M George
[1]UG Student, [2] UG Student, [3] UG Student,[4] UG Student,[5]Assistant Professor
Department of Electronics and Communication,
St. Josephs College of Engineering and Technology, Palai, India

Abstract: Deaf-blindness is unique condition where a person has combined hearing and vision loss. The severity of the impairment varies from one person to another. Some people may be fully blind and deaf, while others may have full vision but partial hearing loss or vice versa. There are different methods like various sign languages, finger spelling, tactile, braille used by them to communicate with others. However, since most normal people are not familiar with these communication techniques, people belonging to these communities feel isolated, lonely and often misunderstood. The aim of this paper is to introduce a system to reduce the communication gap between normal people and people belonging to deaf-blind communities. Using an app on the smartphone normal people would be able to send messages to deaf-blind people. These messages would be received and converted to braille pattern with each alphabet getting converted to its respective braille pattern. Braille is a widely used reading and writing system for visually impaired people and it consists of six dots that are raised or kept flat depending on the alphabet. Instead of dots six vibrators are used to produce vibrations on the finger tips depending on the braille pattern.

***Index Terms* – Braille Gloves, Vibrators, NodeMCU, MQTT**

I. INTRODUCTION

We have a lot of deaf-blind people in our country and as they cannot hear or see, they communicate using sign languages. Since normal people are not very familiar with sign languages, communicating with them becomes very difficult and a lot of times, people belonging to these communities feel isolated, lonely and often misunderstood. This paper is to introduce a system to reduce the communication gap between normal people and people belonging to deaf-blind communities. Braille Based Communication Gloves are worn on both the hands by the deaf blind person and it has vibrators attached to the gloves at the finger tips. Messages can be sent to these gloves and using a microcontroller, these messages are received and converted to the required braille pattern. Depending on the messages sent, the vibrators would vibrate thereby enabling communication between a common man who doesn't know any sign language and a deaf and visually impaired person.

II. LITERATURE REVIEW

Deaf-blindness is a condition in which both the vision and hearing ability of a person is affected. People suffering from deafblindness may be either totally deaf and blind or have a partial hearing and vision loss. Deaf-blindness is of two types-Congenital deaf-blindness where an individual is born deaf blind and acquired deaf-blindness when the person becomes deaf-blind after some age.

People who become deaf first usually learn sign languages, and later when they become blind, they learn variations of sign languages that involves touch. On the other hand, those who develop blindness first usually relies on braille technology, hearing aids, or touch-based alphabet systems. Deaf-blind people often rely on guides who knows how to interpret one of these special language systems as a way to interact with other people. Some deaf and blind people may rely on technological devices like Braille Lite, Braille Tele Caption System. By most standards, these devices are considered very expensive, and many deaf-blind people find it difficult to afford them.

Some of the most common ways a deaf-blind person uses to communicate are various sign languages, speech reading, tactile sign language, finger spelling and Braille. Braille is a system of raised dots that are arranged in a cell in three rows and two columns and are read with the help of finger tips. Each cell represents a number, a letter or a punctuation mark.

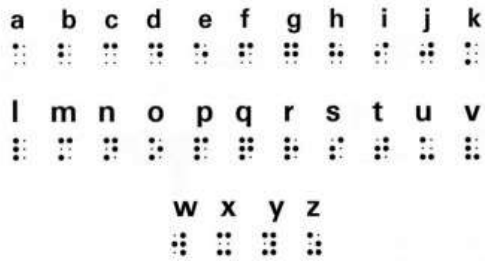

Fig 1. Braille Alphabets

The Braille alphabets are shown in Fig.1

A few projects have been previously undertaken with an aim to lower the communication gap between normal people and people belonging to the deaf-blind community using the common communication methods that blind-deaf people are familiar with. Deaf-Vibe is a system that helps to communicate with the help of tactile sign language [4]. The device converts voice inputs by normal people to vibrotactile output in Morse code. Another system is a Braille Glove with six touch sensors placed on the palm in a manner similar to the braille cell. Six vibrators

have been attached to the other side of the glove in a similar manner. This system makes use of GSM modules and Bluetooth modules and requires different power sources as the power requirement of the system is very high [1].

III. METHODOLOGY

The primary users of these gloves are people belonging to the deaf blind community. Since most blind people are familiar with the braille typewriter, the vibrators are placed on the finger tips. There are three vibrators on each hand which is similar to the braille typewriter.

Fig2. Arrangement of Braille dots in the cell

Arrangement of Braille dots in the cell are shown in Fig.2

Instead of placing the six fingers on the braille typewriter, the vibrators are placed on the fingers and just like a braille alphabet is understood by the raised dots, the alphabets here can be understood through the vibrations produced. Each alphabet would have a different pattern and hence a different vibration. The microcontroller used here is Nodemcu esp8266 as it has wifi integrated into it and since we require gloves for both the hands, we would need two NodeMCUs, one on each hand. Using an app on our smartphone, the messages are sent to the NodeMCUs through wireless data transmission and once they are received, each alphabet in the message would be converted to braille pattern. The vibrators would be switched on if in the braille pattern the dot is supposed to be raised. Using MQTT Dash which is an app that makes use of MQTT protocol, the messages are send from the smartphone to the NodeMCU [2].

a. BLOCK DIAGRAM

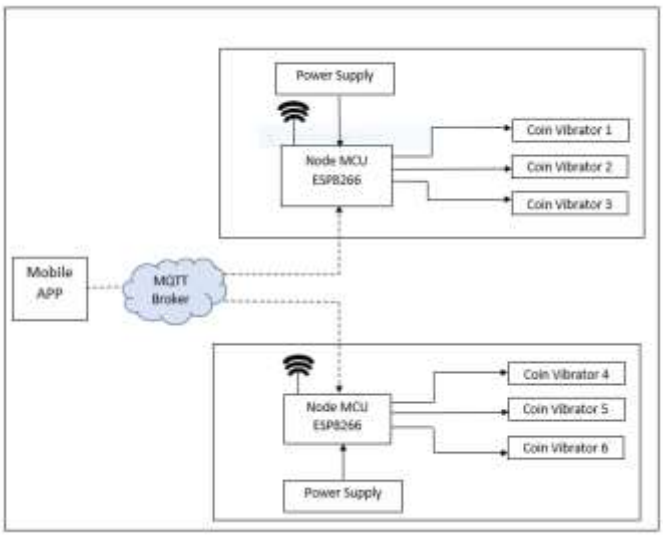

Fig 3. Block Diagram

Using MQTT Dash which is an app that uses the MQTT protocol the messages are sent from the smartphone of the person who wishes to communicate with the deafblind person. This message is received by the two NodeMCU ESP8266 units through wireless communication. These NodeMCU units are powered by a battery source. The messages received are programmed by the NodeMCU to switch on or switch off the vibrators that are connected to it depending on the alphabet. Each alphabet is converted to an equivalent braille pattern vibration. Coin Vibrators are used to produce these vibrations. (Fig.3)

b. FORM DESIGN

Six vibrators are placed on the finger tips on top of the gloves, three vibrators on each hand. The vibrators are placed in such a way that it is similar to the placement of braille cell in a braille typewriter. The NodeMCU is attached to the gloves and are connected to the vibrators using jumper wires. The power supply unit is also attached to the gloves. The user sends messages using an app which is received by NodeMCUs. The NodeMCUs convert the messages to braille pattern and depending on the input alphabets received the vibrators are made to vibrate. These vibrators are attached to gloves and are placed at the fingertips of the hands. (Fig.4)

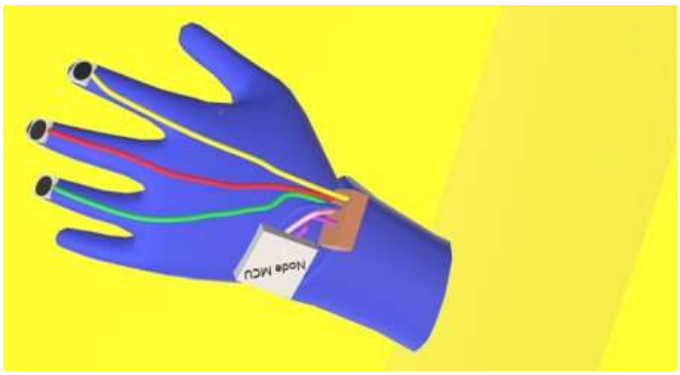

Fig 4. Form Design for One Hand

c. SEQUENCE DIAGRAM

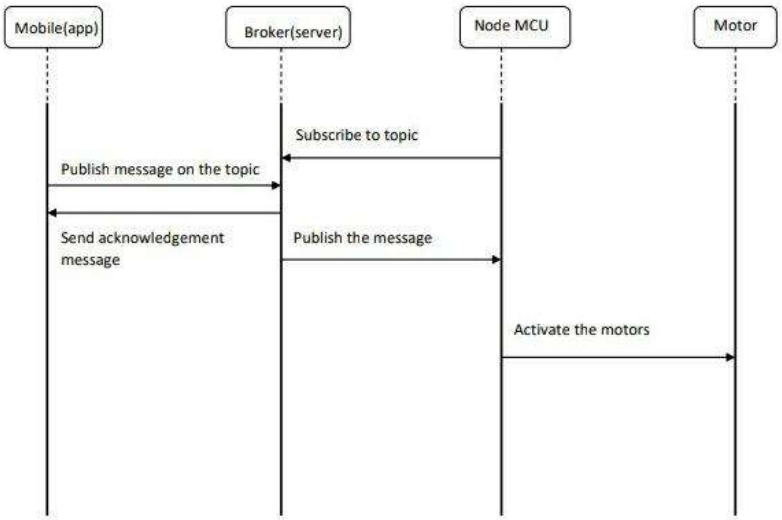

Fig 5. Sequence Diagram

The mobile user sends message to the deaf and blind person using the MQTT Dash app. These messages are received by two Node MCUs which then converts the message from ASCII form to a braille pattern. The braille pattern consists of six dots that are raised or kept flat depending on the alphabet. Here, instead of the raised dots, we give vibrations to the vibrators. The NodeMCU is programmed to control the vibrators depending on the input message. Each NodeMCU is connected to three vibrators each. The app publishes the message to a topic on the broker. The NodeMCU is subscribed to the same topic on the broker. So when a message is sent from the app, the NodeMCU receives it and it then activates the motors depending on the letters received for a finite amount of time. (Fig.5)

d. FLOW CHART

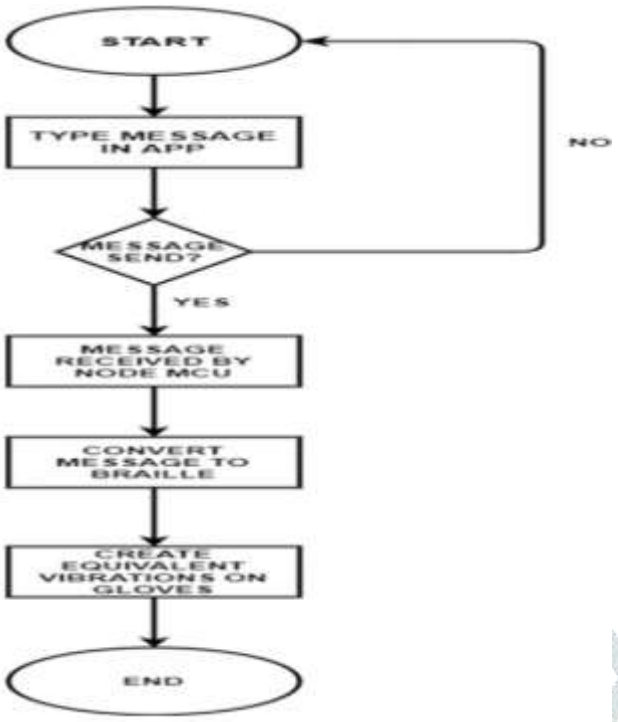

Figure 6. Flow Chart

Flow chart is shown in Fig.6

e. ALGORITHM

1. Initialize ESP8266 WiFi library.
2. Initialize MQTT library.
3. Define strings to hold to the network name(SSID),network password and MQTT server.
4. Create a client that can connect to a specified internet IP address.
5. Initialize the digital pins.
6. Start connecting to the Wifi ; if not connecting , reconnect. 7. Connect to MQTT; if not connecting , reconnect.
8. Start to receive messages.

If letter = A or a ; set D2 high, and D1,D5,D6,D7 low.
Else if letter = B or b ; set D2 ,D1 high ,rest low.
Else if letter = C or c ; set D2 ,D6 high ,rest low.
Else if letter = D or d ; set D2 ,D6,D7 high ,rest low.
Else if letter = E or e ; set D2 ,D7 high.
Else if letter = F or f ; set D2 ,D1,D6 high .
Else if letter = G or g ; set D2 ,D1,D4,D7 high.
Else if letter = H or h ; set D2 ,D1,D7 high.
Else if letter = I or i ; set D1,D6 high.
Else if letter = J or j ; set D1,D6,D7 high.
Else if letter = K or k ; set D2 ,D5 high.
Else if letter = L or l ; set D2 ,D1,D5 high.
Else if letter = M or m ; set D2 ,D5,D6 high.
Else if letter = N or n ; set D2 ,D5,D6,D7 high.
Else if letter = O or o ; set D2 ,D5,D7 high.
Else if letter = P or p ; set D2 ,D1,D5,D6 high.
Else if letter = Q or q; set D2 ,D1,D5,D6,D7 high.
Else if letter = R or r; set D2, D1,D5,D7 high.
Else if letter = S or S ; set D1,D5,D6 high.
Else if letter = T or t ; set D1,D5,D6 ,D7 high.
Else if letter = U or u ; set D2,D5,D8 high.
Else if letter = V or v ; set D2,D1,D5,D8 high.
Else if letter = W or w ; set D1,D7,D8,D6 high.

Else if letter = X or x ; set D2,D5,D6,D8 high.
Else if letter = Y or y ; set D2,D5,D6,D7,D8 high.
Else if letter = Z or z ; set D2,D5,D7,D8 high.
9. Add time delay between each letter and word.

IV. RESULT

The vibrators were placed on the fingertips and attached to the gloves and connected to the NodeMCU. Using the MQTT Dash app messages were sent and the intensity, speed and sensation produced by the vibrators were analyzed.

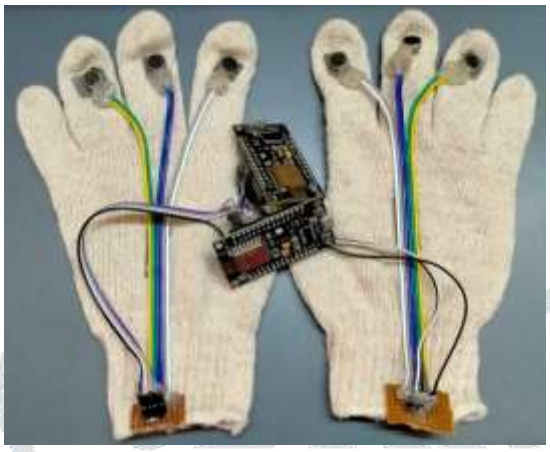

Fig.7 Hardware Implementation

V. CONCLUSION

Deafblindness is a dual sensory impairment which causes various degrees of hearing impairment and low vision. Even though it has been included as one of the multiple disabilities under The Rights for Persons with Disabilities Act of 2016, a lot of deafblind people are still discriminated and often isolated from the society. One of the major reason for this isolation is the communication gap be- tween normal people and people belonging to the deafblind community. Braille Based Communication Gloves aims to reduce this gap and help make our society a better place to live for people with this impairment.

VI. REFERENCES

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