Arduino Based Voice Conversion System for Dumb Persons Using Touch Sensors

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Abstract. Everyone talks to each other by using sounds to get their point across. But this isn't good for people who are deaf or dumb. There are several ways for them to get their views over to average people, such as using hand gestures, facial expressions, and body language. Also, people commonly utilize sign language to talk to each other. Each word has a specific action that shows how it is used. Gestures don't work very well because most individuals don't know how to use them. So, it makes sense to set up a system that makes it easier for dump people to share information. Sign language can be turned into speech with the help of infrared and touch-based sensors. This method for recognizing gestures uses infrared and touch sensors. The Arduino gets input from the infrared and touch sensors based on their resistance and then makes a voice output. This system reacts faster and makes communication more efficient. One of the key goals of gesture recognition research is to make a system that can recognize human gestures and send data to control devices. Processors utilize hand and body motions to talk to one other. We can understand how people move and utilize gestures to control machines or software by using this strategy.

1 Introduction

People typically talk to each other to get to know each other. The number of foolish victims has quickly gone risen in the last few years because of accidents, mouth disorders, and birth deformities. People who are not smart can't talk to regular people and have to use visual signals instead. The purpose of this work is to help people with disabilities become full members of society. People mainly talk to each other to interact. The number of stupid victims has quickly gone risen in the last few years because of accidents, mouth disorders, and birth deformities [1].

People who are not smart can't talk to regular people and have to use visual signals instead. The goal of these kinds of projects is to help these people with special needs become equal members of society [2].

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Communication is an art that makes it easier to share ideas, thoughts, and information. People talk to each other, yet some people are different. Some people are deaf or hard of hearing. These people have learned to talk to each other using body language, facial emotions, and the way they move their hands. The most common way for them to talk to each other is through sign language. Gestures are hard for most people to understand. Because of this, people with this disability are more likely to have problems in society that have to do with their bodies, jobs, and education [3].

They are quite lonely and have to cope with a lot of social problems throughout their life. They will benefit from a system that is designed to convert sign language into speech. The APR voice module may record and play back voice how the user wants it to. It runs on 5V DC power and contains eight voices, all of which are very loud. When the module is in recording mode, you can record the voices by hitting the key that corresponds to low level. When you press back, it can play back voice based on how the flex sensor moves. This sign language recognition technology picks up on the gesture and translates it into speech so that those who can't hear or talk can comprehend what the people who can hear or speak are thinking [4].

Gesture recognition is the way that a disabled person interacts with computers without speaking, using simply hand gestures and body language. This lets the system understand what users want and send them specific messages. Because bodily gestures are a good way to talk to people in real life. Sign languages are made up of nothing but a series of bodily movements [5]. This system suggests that gesture input can be a useful way to both send information and control devices. It does this by detecting gestures made by the human body. a study of how well computers and people get along and how well a system responds to a disabled person's individual movements [6]. Using motion redeployment, we built a structure that container understand hominoid motions and provide information towards control devices. Hand gesture recognition and recognizing emotions from the face are two of the most important areas of research right now [7]. Gesture recognition techniques include recognizing and identifying proxemics, postures, gaits, and human movements.

2 Literature Review

Author Kishore Kumar et al. [8] initiated with a research paper, "Hand Gesture Recognition and Voice Conversion System utilizing IoT." The proposed paradigm there are about nine billion dumb people on Earth at any given time. Statement breaks among hard-of-hearing and earshot audiences, as well as the statement gap between unsighted and prehistoric sighted people, are significant problems. The major purpose of this research remains toward find a way to turn verbal motions into transcript besides audio. The structure has a home web with devices, actuators for appliances, and cameras that provide information to the controller. A Raspberry Pi microcontroller serves as the user interface and links to a relay.

Vardhan et al. [9] written the article "Hand Gesture Recognition Application for Physically Disabled People", talks about an IJSR project. Gesture recognition is the use of a disabled person's movements to control a device or send information. Using body language is a good technique to talk to people in everyday life. A full language can be made up of a group of physical gestures, just like symbol lingos. They container send a broad spectrum of realities too emotions efficiently. This mission modestly claims that gesture-based input, which employs unique human motions to recognize input, is a great way to control gadgets or share information. Gesture research in the area of human-computer interaction is still in its early stages, and we hope that we have inspired others to come up with new ways to create useful gestures.

Abhilasha et al. [10] a study presented "Smart Glove for Hearing-Impaired". This essay goes into detail about how deaf and stupid people could use sign language as a natural way to talk to each other. People usually become excited when they see hand gestures in language conversation. A gesture can also mean a movement, such a hand motion, that shows a concept. Linguistic communication is a specific way of communicating that allocates a gesture to each word or letter. Most of the time, it's hard intended for outmoded peoples toward understand the symbols besides pardon they need near say. Used for example, let's say that a conventional disabled person who is hard of hearing wishes to talk to a certain UN organization.
Jayasree et al. [11] wrote a broadside called "Gesture based Assistance system for Aphasia patient". In it, they came up with unforeseen situations lead to unforeseen events. An accident is one of them. Things that we don't expect to happen right now could happen very quickly. Also, in a situation that isn't apparent, it could tip and lose the voice cord. People with aphasia are those who have lost their voice chord. Getting out of the situation isn't easy. Right now, their biggest problem is that they can't get their ideas out there. There is an effect on the way the patient and everyday people interact, which could lead to decreased communication and low self-esteem. To understand how people with aphasia feel, it's important to talk to them. It will be hard for average people to talk to these people at the same time. Then, the only method to communicate without speaking is by gestures. It is how people discuss what they know about the current state of affairs. A gesture is a way to communicate yourself that shows how your fingers move in a big way.
Vijayakumar et al. [12] written the article "Hand Gesture to Speech and Text Conversion Device". They offer modules that you can use for A large number of individuals on Earth can't talk to each other at all, or at least not very well. Only a small number of people trendy India—about 2.78 per hundred of the residents as a whole stay good at communicating using hand gestures. It's unlikely that the typical impaired person will learn sign language. So, it is becoming more and more important to do research on gesture-to-speech (G2S) systems in order to bridge the communication gap. In the last several years, a lot of academics have come up with different ways to work in robotics and artificial intelligence, with a focus on detecting hand gestures [2]. This plan uses a similar approach, tries to use knowledge in a new way and has developed an important application for the Internet of Things. This device lets both deaf and dumb individuals talk to each other.

3 Components Used

3.1 Arduino Nano

The Arduino Nano as shown in Fig. 1, is a compact board that is easy to use with a breadboard and has a lot of features. It is based on the ATmega328P (Arduino Nano 3.x). The Arduino Duemilanove and this one have almost the same features, but they come in different boxes. It doesn't have a regular USB port; instead, it has a Mini-B USB port. It also doesn't have a DC power jack. No matter how big or small the work, it can do it. Use 170 x 250 mm paper size (W x H mm) and adjust the margins to those shown in the Table 1. The final printed area will be 130 x 210 mm. Do not add any page numbers.

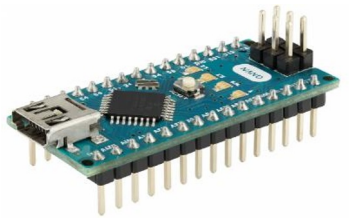

Fig. 1. Arduino Nano

There are digital I/O pins (D0-D13) on the Arduino Nano that can be used for general inputs and outputs. D0 and D1 are also used for serial (Tx/Rx) communication. It contains analogue input pins (A0–A7) that can read voltage signals in an analogue way. The board features power pins (VIN, 5V, 3.3V, and many GND) that send electricity to the board and other parts, as well as power-related pins like the RESET pin to reset the microcontroller as shown in Fig. 2.

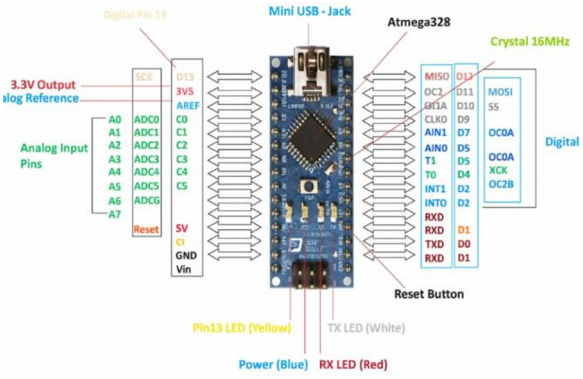

Fig. 2. Pin Diagram of Arduino Nano

3.2 Arduino nano

An infrared sensor (IR sensor) as shown in Fig. 3, is an optoelectronic part that can detect radiation and is sensitive to wavelengths of light in the range of 780 nm to 50 µm. A number of motion detectors these days employ infrared sensors to discover people who shouldn't be there or to turn on lights in buildings [10]. People can't see infrared radiation, but the infrared sensor can [11]. An infrared sensor is a photodiode that can pick up infrared light. The most current it can handle is 20mA, and the power source can be either 3.3V or 5V. A passive infrared module without a transmitting bulb is usually used to find heat. IR is the short form for infrared light.

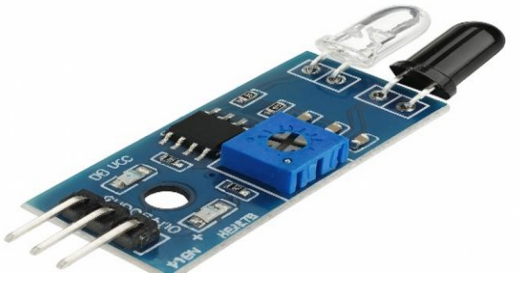

Fig. 3. IR sensor.

3.3 Touch sensor

A touch sensor as shown in Fig. 4, is a gadget that can find and record physical contact or an embrace on a device or item. It lets an object or gadget know when it is being touched or is close to anything else, generally by a disabled person [12]. They are easier to use and more reliable because they don't have any moving parts. Touch sensors minimize the overall cost of the device and provide the designer more creative freedom [13]. It is used in buttons and touchpads that turn on a switch when you touch them. This touchpad lets you use your finger to move things around instead of a stylus [14].

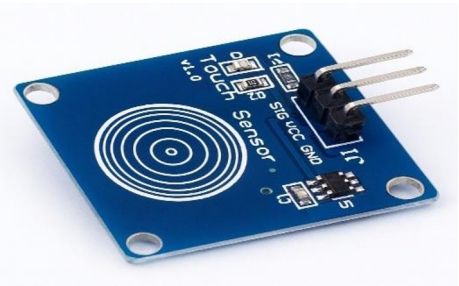

Fig. 4. Touch sensor.

3.4 LCD

An LCD stands a flat-panel demonstration otherwise another by machine precise photosensitive expedient as shown in Fig. 5, that uses polarizers and liquid crystals to change how light behaves [15]. Light is not emitted directly by liquid crystals. Instead, they reflect light off of a backlight to generate color or black-and-white images.

Fig. 5. LCD.

3.5 Buzzer

A buzzer or beeper is a sound-making device that can be mechanical, electromechanical, or piezoelectric as shown in fig.6. Buzzers and beepers are widely used in alarm systems, timers, teaching tools, and to show that a user has done something, like clicked a mouse or typed on a keyboard.

Fig. 6. Buzzer.

3.6 APR33A3 Voice Recorder and Playback Module

The APR33A3 Voice Recorder and Playback Module as shown in Fig. 7, has 8 built-in channels for recording and playing back sound. It also comes with a small test speaker that can emit 0.5 watts. There is a 1/2W speaker. There are pins on the microcontroller TTL interface that are not soldered to the board for ground. The excellent APR33A3 Voice Recorder and Playback Module makes it easy for people to record and listen back audio recordings. It contains a built-in microphone, a headphone socket that works with 3.5mm headphones, and support for a number of audio formats.

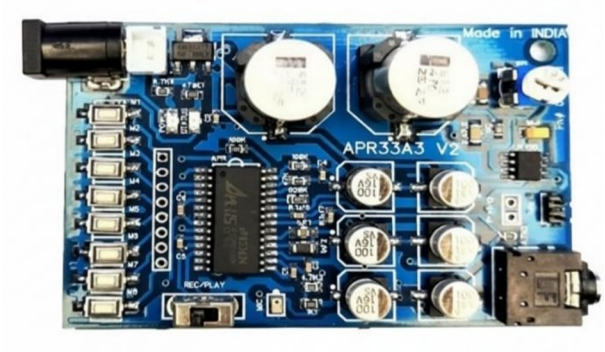

Fig. 7. APR33A3 Voice Recorder and Playback Module.

3.7 I2C

The Phillips Corporation made the Inter-Integrated Circuit (I2C) bus as shown in Fig. 8, which is a two-wire serial interface, for use in consumer items at first. It is a two-way bus that makes it easy for ICs to talk to each other and is easy to make in any IC process, such as NMOS, CMOS, or bipolar.

Fig. 8. I2C.

3.8 Voltage Regulator

A voltage regulator as shown in Fig. 9, is a circuit that makes sure the output voltage stays the same no matter what happens to the input voltage or the load. Voltage regulators, or VRs, make sure that the power supply's voltages stay within a safe range for the other electrical parts. A voltage regulator always produces the same output voltage, no matter what happens to the input voltage or the load. There are two types of voltage regulators: switching and linear.

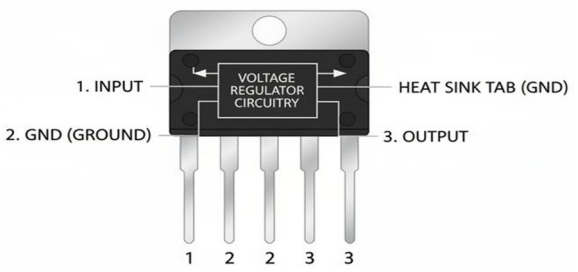

Fig. 9. Voltage Regulator.

3.9 Speaker

Speakers are popular output devices in computer systems as shown in Fig. 10, that let people hear sound. Some speakers can only be used when they are plugged into a computer, while others may be plugged into any sound system. A speaker is made up of a cone, an iron coil, a magnet, and a housing (case). When the speaker gets power from a device, it moves back and forth. This movement makes the outer cone vibrate, which sends sound waves that our ears can hear.

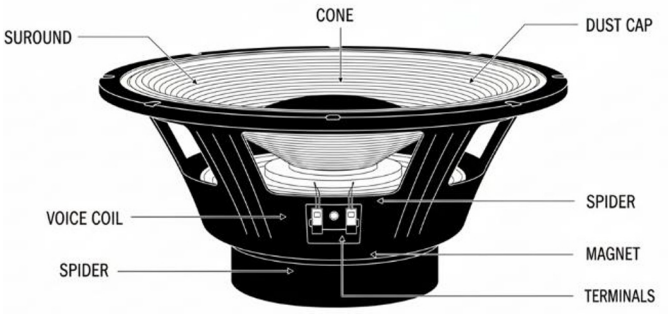

Fig. 10. Speaker.

4 Methodology

When the device is turned on, the AC voltage is lowered and changed to DC voltage, which is what the Arduino Nano needs. The Arduino Nano is already set up and can read data from a flex sensor. It reads the input when the infrared and touch sensors are bent forward. The block diagram and flow chart of the work are shown in Figs. 11 and 12.

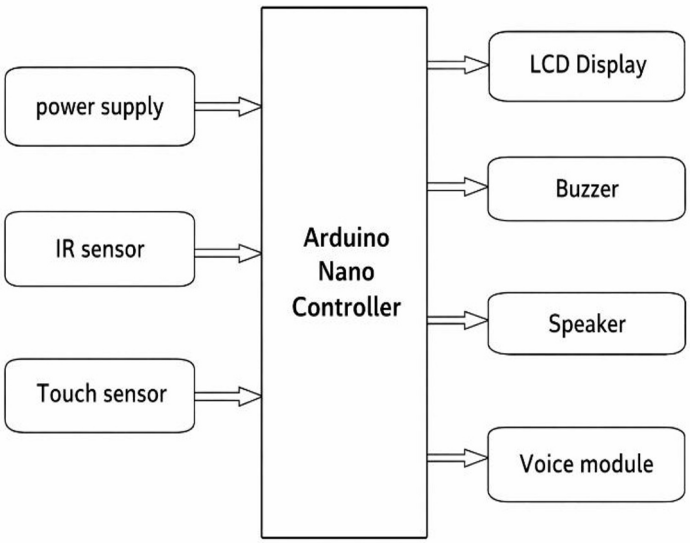

Fig. 11. Block Diagram.

The MEM sensor measures how touch and infrared sensors are oriented. This gesture recognition system uses a microcontroller to read the user's sign language and turn it into speech. The whole system is run by the Arduino Nano. The Arduino software tells the CPU ATMEGA328 to look for changes in the resistance values of the IR and Touch values. When it finds one, it makes the voice output that goes with it.

4.1 Algorithm

- Start
- Initialize Components: Initialize the Arduino board, configure all touch sensors as

inputs, Initialize the audio module/speaker output, Load pre-recorded voice messages (e.g., “I need water,” “Help,” “Thank you,” etc.)

- Consistently Observe Sensors: Retrieve data from each touch sensor, determine if any touch sensor is activated.
- Identify the pressed sensor:
    - If Sensor 1 is activated, select Voice Message 1, If Sensor 2 is activated, select Voice Message 2, If Sensor 3 is activated, select Voice Message 3, If Sensor N is activated, select the matching message.
- Execute Corresponding Voice Output: Transmit command to audio module, Play the designated pre-recorded message over the speaker
- Implement a brief delay to prevent recurrent activation.
- Revert to Step 3 (Continuous loop)
- End

4.2 Flow chart

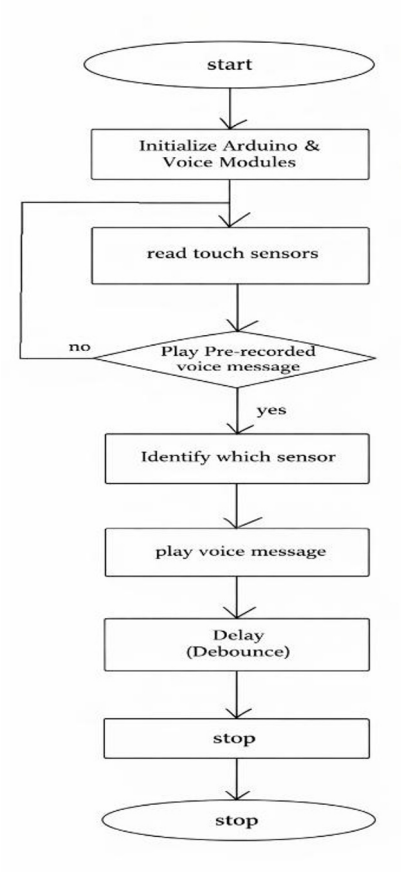

Fig. 12. Flow chart.

Table 1. Comparison between IR And Flex Sensors.

IR sensors	Flex sensors
Low power consumption	High power consumption.
Simple design.	Complex design.
No risk in handling the sensor.	High risk in handling the sensor.
No Risk of maintaining the sensor to be in the fixed position.	Should not Keep the sensor in the bend state for a long time.
Less expensive when compared to Flex sensors.	Highly expensive

5 Results and discussion

Figure 13 shows the whole hardware package we used to finish the project. It shows that all the parts were utilized and that it was connected to an Arduino Nano, an LCD display, and a speaker. This prototype was hooked up to the touch sensors and the different pins on the APR33A3 Voice Recording and Playback Module. It was also hooked up to the speaker and display.

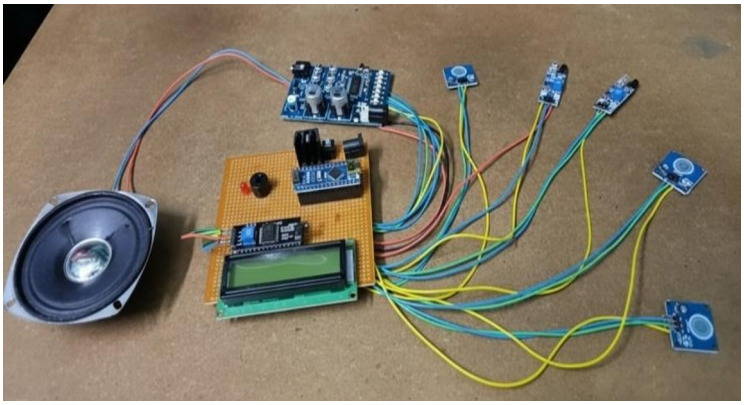

Fig. 13. Experimental Setup.

Below are the various outcomes we are getting from our hardware kit and are shown in Figs. 14-18. The graphic above shows the different effects that came about after connecting all the parts. When people who are dumb or mentally disabled are in certain situations, they can touch any of the sensors. This turns on the APR33A3 voice recording and playback module, which connects to the LCD's pins and shows the output on both screens at the same time while also playing the voice output through the speaker. For instance, if someone is hungry, they can touch the sensor, which turns on the display and shows "I am hungry!" at the same time as the speaker makes the same sound. If the disabled person isn't getting enough oxygen to breathe, the LCD will show "I am not able to breathe" and make the same sound every time they touch the sensor. This sensor was also connected to the red LED, which makes people nearby active just by looking at the red LED.

Fig. 14. LCD display- I am not able to breath.

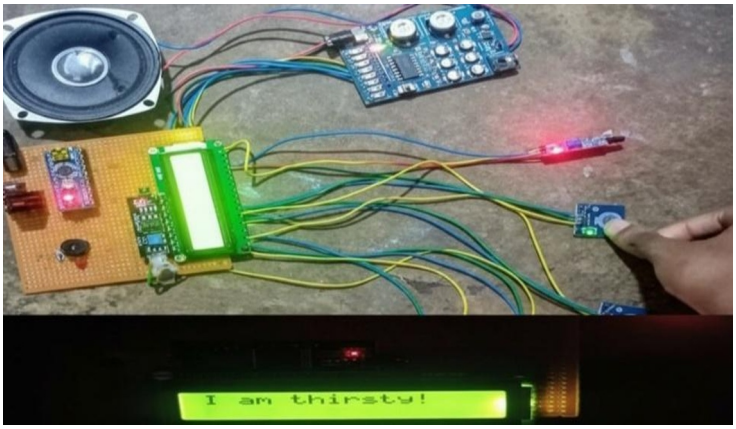

Fig. 15. LCD display- I am thirsty.

Fig. 16. LCD display- I am suffering with body pains.

Fig. 17. LCD display- I am feeling headache.

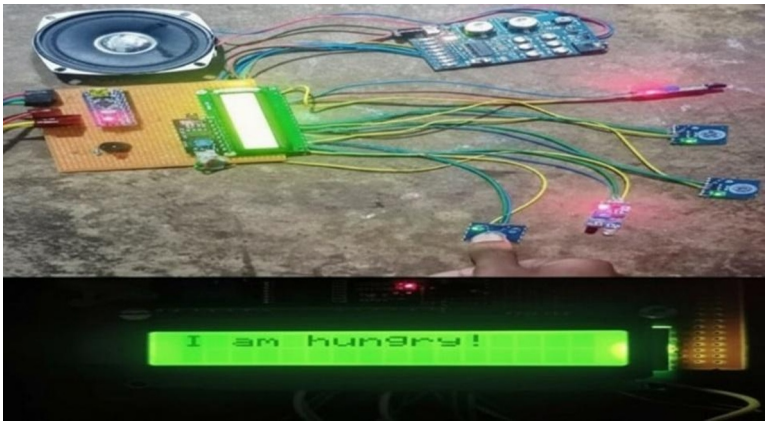

Fig. 18. LCD display- I am hungry.

6 Conclusion

People who can hear and talk don't know how to use sign language to communicate their ideas and thoughts. They need to learn how to read the motions. The solution that was built gets around this problem and helps people talk to each other better. The device is small, doesn't use much power, and is cheap. Sign language is one of the best ways for deaf and mute people to talk to others who can hear and speak. You can use sign language to talk to someone, but they have to know it, which isn't always doable. So, our project makes it easier to get around these problems.

The glove can turn their sign language signals into voice using an Android phone. The smart glove focuses on translating motions that spell out words. Smart glove uses Principle Component Analysis to sort real-time input data for feature extraction, which is different from other methods. Disabled people use these gloves to turn the signs they make into speech and text. This document is a helpful tool for patients who can't speak or are partially paralyzed. It helps patients, doctors, and family members talk to each other.

7 Future Scope

This system can be made bigger in the future to accommodate more words in a language. It might possibly speak more than one language. A translator may also be built into the device. This makes it possible for disabled persons who can't speak or hear to travel alone around the world. So they can feel safe and confident. So, the gesture recognition system that was made for this project combining sensor fusion and gesture recognition techniques offers a lot of future possibilities that need to be thought about in order to aid these people with disabilities even more. This smart glove makes it easy to tell the difference between a disabled person who can't speak and a normal person who can. The mobile app can be improved in quality, which will allow for a lot of technical quality research to be done on what has to be done to help them more in the future. We made it work on Android OS, but in the future, we might make it operate on any platform. We may also cut down on the number of wires that connect things to make it easier to wear. It can be used in many places, like airports and train stations, to help people who can't speak. One additional technological problem that can be solved is helping multi-gesture at a faster speed, which is when this device's precision sometimes doesn't reach the peak. To improve and promote better signal recognition, a movement handling unit might be included.

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