

Speaking System for Dumb People Using Hand Gestures

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Abstract: Speech is the easiest way for communication in the world. It becomes difficult for speech impaired people to communicate with normal people as they use sign language for communication. When a speech-impaired person communicates with normal person, the gap between speech impaired and normal masses is too much to fill. The gesture recognition can be done in two ways, Image processing based and sensor-based. The "Smart Gloves for Deaf and Dumb People" project seeks to provide practical solution for individuals with speech and hearing impairments, enabling them to communicate more easily with others. The project utilizes an ESP32 micro-controller, a versatile and powerful platform, to control and process the data from touch sensors integrated into the gloves. These touch sensors are designed to recognize specific hand gestures made by the user, with each gesture corresponding to a particular rerecorded voice message. The APR33A3 voice record and audio playback board plays a critical role in this project, as it stores and outputs audio files linked to the detected gestures. By using the board's 8-channel capability, a range of messages can be stored, providing a variety of responses for different gestures. The system is aimed at enhancing communication for individuals who are deaf or mute by translating sign language or hand gestures into audible speech, thereby improving interaction with others and enhancing social inclusion. This innovative approach combines hardware, software, and audio technology to create a user-friendly tool that empowers individuals with disabilities to express themselves in a more natural and effective manner.

1. INTRODUCTION

In the present world, it is very complicated for the deaf and dumb people to talk with the ordinary people as impaired people lack the amenities. It actually becomes the same problem of two persons which knows two different language, no one of them knows any common language so its becomes a problem to talk with each other and so they requires a translator physically which may not be always convenient to arrange and this same kind of problem occurs in between the Normal Person and the Deaf person or the Normal Person and the Dumb person. Although technology has been evolving rapidly in this information age, deaf/mute people still use Sign language as their only way of communication. Using sign language, a communication tool can be beneficial among those who are familiar with this language, but the problem remains when communicating with the wider community. Sign Language Translator is the appropriate solution that enables deaf and mute people to communicate fluently through technology in different languages. As sign language is a formal language employing a system of hand gesture for communication by the deaf people, many projects used glove based systems for automatic understanding of gestural languages used by the deaf community. The systems developed in these projects differed in characteristics such as number of classifiable signs, which could range from a few dozen to several thousand, types of signs, which could be either static or dynamic, and percentage of signs correctly classified. The simplest systems were limited to understanding of finger spelling or manual alphabets a series of hand and finger static configurations that indicate letters. Hand movement data acquisition is used in many engineering applications ranging from the analysis of gestures to the biomedical sciences. Glove-based systems represent one of the newest and important efforts aimed at acquiring hand movement data. While they have been around for over three decades, they keep attracting the interest of researchers from increasingly diverse fields. The development of the most popular devices for hand movement acquisition, glove-based systems, started about 30 years ago and continues to engage a growing number of researchers. We choose to study the glove systems for sign language understanding. The aim of the project is to develop a hand glove equipped with sensors Touch sensor which sense different sign language gestures. Flex sensors are placed on fingers which measure the bending of fingers according to a gesture made- An accelerometer is placed on the palm which measures the location of the hand in X, Y, Z axes. Touch sensors are placed in between the fingers and measures if there is any contact between the fingers. Firstly sensors were simulated to extract the sensed data. Secondly the sensed data from sensors is sent to ESP32 for further processing and transfer data to an android phone via

Bluetooth module. The data will be in the form of text. This text data is then converted into speech through Google text - speech converter.

2. LITERATURE SURVEY

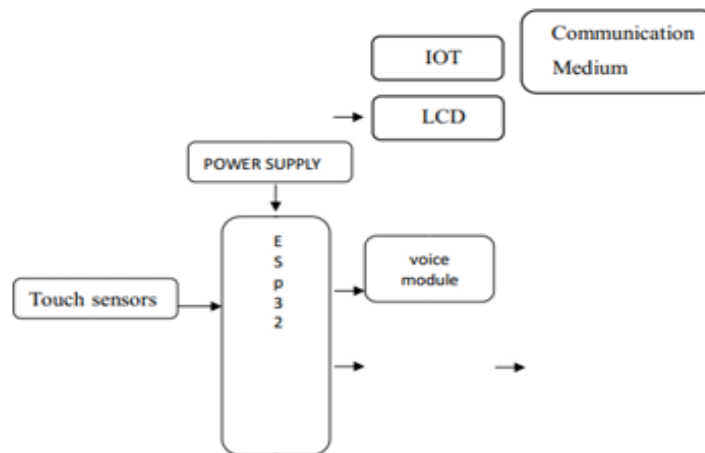
This paper presents a smart glove System that can continuously recognize sign language gesture and translate that into spoken words. The glove is fitted with a flex-sensors and magnetometer sensor to sense the movement made by fingers. New gestures can be added to the existing gesture library. This gives the system the flexibility to meet the high degree of variation among sign languages, and also the need to do some custom gestures for the industrial work. Sign language is used by deaf and mute people and it is a communication skill that uses gestures instead of sound to Convey meaning simultaneously combining hand shapes, orientations and movement of the hands, arms or body and facial expressions to express fluidly a speaker's thoughts. Gesture is a non-verbal form of communication. The series Of gestures such as hand movements and facial expressions indicating words are referred to as sign language. Sign language recognition systems are used to convert sign language into text or speech to enable communication with people who do not know these gestures. Usually, the focus of these systems is to recognize hand configurations including position, Orientation, and movements. The proposed work Hand gestures are strong medium of communication for hearing impaired society. The deaf and dumb make use of sign language to communicate which is difficult to interpret by the individuals who are not well-aware of it. Thus, there is a need of building up a device that can interpret the gestures into text and speech. The main goal of this project is to create a smart glove system that can continuously recognize sign language gesture and translate that into spoken words. It is a new technique called artificial speaking mouth for dumb people. The glove is fitted with a flex-sensor and a magnetometer to sense the movement made by fingers. A low power ARM Cortex-M4 micro-controller recognizes the movement by means of acquiring, processing and running a sensor fusion algorithm. The system translates the sign recognized into meaningful text. This text is then transferred to a smartphone app over a Bluetooth channel where the text will be converted into speech. Another feature that makes this project interesting is that users can teach the system new gestures and add them to the existing standard gesture library. Digital text and speech synthesizer using smart glove for deaf and dumb perhaps the single quality most central to humanness is the ability to exchange thoughts, ideas, and feelings with others. The importance of the capacity to connect with other people cannot be overstated. Helen Keller was once asked, if she could have either her vision or her hearing, but not both, which would she choose? Without hesitation, she replied, "My hearing" When asked why, she responded, "blindness separates a person from things, but deafness separates him from people". Persons with severe and profound disabilities may be especially vulnerable to this problem of separation from the mainstream of society. Federal legislation has defined persons with severe disabilities as those "who because of the intensity of their physical, mental, or emotional problems, need highly specialized education, social, psychological, and medical services in order to maximize their full potential for useful and meaningful participation in society and for self-fulfillment. Many individuals who have severe disabilities experience substantial difficulties in communicating effectively with those around them with the advent of wearable technology, it is now possible to implement numerous and extremely creative ideas to serve humanity in unprecedented ways, Thus, Came the idea Of such a System which can act as a medium for deaf and dumb people to communicate and convey their feelings in a more appropriate and efficient manner. Due to communication gap deaf and dumb community is restricted in small social circle and is not able to mix up and interact with normal masses. This proposed system is a path towards the breaking of this communication gap. Smart glove is a system which comes under the category of Augmented and alternative communication, Augmentative and alternative communication (AAC) is a prominent component in the development of support services for individuals with disabilities, especially those with severe disabilities. Technologies Such as augmentative and alternative communication (AAC) systems can help to minimize this separation from other people. An AAC System is an integrated group of components, including the symbols, aids, strategies, and techniques used by individuals to enhance communication'. These technologies range from relatively low-tech systems (i.e. simple adaptations with no batteries or electronics, Such as communication boards). AAC systems may be roughly classified into one of two categories: unaided communication systems and aided communication systems. Unaided AAC systems do not require any sort Of external communication device for production of expressive communications. Sign language, facial expressions, gestures, and non-symbolic vocalizations are all unaided modes of communication; Aided systems require an external communication device for production. Smart glove for deaf and dumb using flex sensors and tactile sensors, a system which consisted of flex sensors, tactile sensors and accelerometer. Their hardware requires 5V DC and hence a voltage regulator of 7800 series (7805) is used. LEIY's are used which informs about the supply being activated. A 3300 resistor is used to drop the voltage and make it 2-2.5V as required by the LED. The deflection of the flex with a minimum angle Of 400 a resistance is obtained which is increased by bending and voltage is obtained. Four flex sensors along with their connection ports are p laced. The voltage is in millivolt s so op-amp (LM358) was used to amplify it. The op-amp used is a non-inverting type with high voltage gain. RF resistor is variable resistor with (0-10) k and RI is 2.2kn- A 33k resistor is used at the output of op-amp which stops the voltage from being grounded. PICI 6F877 a peripheral interface controller is used with flash memory 8kb and an inbuilt ADC converter with 10 bit resolution. The micro-controller Converts the analog output into digital and provides a high and low

voltage. A crystal oscillator with 12MHz is used which provides the microcontroller with frequency clock pulse- Two 33pF capacitors are used along with the oscillator.

3. PROJECT DESIGN

Sign languages are visual languages that use hand, facial and body movements as a means of communication. There are over 135 different sign languages all around the world including American Sign Language, Australian Sign Language and British Sign Language. There are also signed representations of oral languages such as Signed Exact English and mixes such as Pidgin Signed English Sign language is commonly used as the main form of communication for people who are Deaf or hard of hearing, but sign languages also have a lot to offer for everyone. Sign languages are an extremely important communication tool for many deaf and hard -of-hearing people. Sign languages are the native languages of the Deaf community and provide full access to communication. Although sign languages are used primarily by people who are deaf, they are also used by others, such as people who can hear but can't speak. People who know a sign language are often much better listeners. When using a sign language, a person must engage in constant eye contact with the person who is speaking. Unlike spoken language, with sign languages a person cannot look away from the person speaking and continue to listen. This can be an extremely beneficial habit to have for spoken language as well as sign language. By maintaining eye contact in spoken language, it shows that a person is genuinely interested in what the other is saying.

Block Diagram



Hardware Design: The ESP32 is a powerful and versatile micro-controller board developed by Espressif Systems. It is widely used in a variety of embedded systems projects due to its performance, low power consumption, and integrated wireless communication capabilities, The ESP32 is the successor of the popular ESP8266, offering a wide range of improvements and features, including Bluetooth, Wi-Fi, and enhanced processing power. Key Features of the ESP32t:

1. Dual-Core Processor: The ESP32 is equipped with a dual-core processor based On the Xtensa@ 32-bit LX6 architecture, running at a Clock speed Of up to 240 MHz This provides excellent processing power for handling multiple tasks simultaneously, making it ideal for projects that require real-time decision-making and efficient data handling.
2. Wireless Communication: One of the standout features of the ESP32 is its integrated wireless capabilities. It supports both Wi-Fi (802.11 b/g/n) and Bluetooth (classic and BLE Bluetooth Low Energy), making it suitable for a wide range of IoT (Internet of Things) applications. The ESP32 can easily connect to wireless networks, exchange data with remote devices, and communicate with other Bluetooth-enabled devices, providing flexibility in building connected systems.
3. Memory: The ESP32 typically includes 520 KB Of SRAM and can support external flash memory up to 16 MB or more, depending on the board version. This ample memory allows for the storage of large programs, data buffers, and external resources like sensor data or audio files, which is crucial for projects that involve complex processing tasks.
4. GPIO (General Purpose Input/Output): The ESP32 provides a broad array of GPIO pins, typically ranging from 34 to 39 pins, depending on the specific model. These pins can be used for a variety of purposes such as digital input, digital output, PWM (Pulse Width Modulation), analog input, and more. These versatile pins are perfect for interfacing with sensors, actuators, and other external components like the touch sensors and voice playback modules in the "Smart Gloves for Deaf and Dumb People" project.
5. Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAO: The ESP32 includes 12-bit ADCs and DACs, enabling the board to interface with analog sensors and process analog signals, For example, the ADCs allow the ESP 32 to read data from analog sensors (such as temperature or light

sensors), while the DACs can generate analog signals if needed for audio output or other applications. 6. Low Power Consumption: One of the key advantages Of the ESP32 is its low power consumption, which is critical for battery-operated projects. The board supports several modes, including deep sleep, where the board consumes only a small fraction of its normal power. This feature is particularly useful in wearable devices like the smart gloves, as it allows for extended battery life without sacrificing performance. 7. Integrated Touch Sensors: The ESP 32 includes capacitive touch sensor pins, which are particularly useful in projects where touch input is required. This feature can be leveraged in projects like the smart gloves, where hand gestures or touch-based interaction is central to the user experience. These touch pins can be used to detect gestures or finger movements and trigger appropriate actions based on the input. Support for Development Frameworks: The ESP32 is highly compatible with several development platforms, notably the Arduino IDE and Espressif's Own ESP-IDF (Espressif IOT Development Framework). This flexibility makes it easy to program and develop Custom applications for the ESP32, whether you're using a simple, user-friendly interface like Arduino or a more robust, professional environment like the ESP-IDF. 9. Bluetooth LE (Low Energy) and Classic Bluetooth: The ESP32 supports both Bluetooth LOW Energy (BLE) and classic Bluetooth. This makes it highly suitable for projects that require communication with other Bluetooth-enabled devices such as smartphones, tablets, or computers. BLE 's low power Consumption is particularly beneficial for wearable devices like smart gloves, where energy efficiency is crucial. I Integrated Hall Sensor and Temperature Sensor: The ESP32 has built-in hall-effect sensors for detecting magnetic fields and internal temperature sensors, which may be useful for certain IOT projects where environmental sensing is needed. Although these features may not be directly related to the Smart gloves, they add to the overall versatility of the board-I I - Advanced Peripherals: In addition to GPIO pins, the ESP32 has a variety Of advanced peripherals, including SPI (Serial Peripheral Interface), I2C, UART (Universal Asynchronous Receiver/Transmitter), PWM, and I2S (Inter-IC Sound). 12. These interfaces make the ESP32 ideal for connecting with a variety Of external devices, such as sensors, displays, and sound modules like the APR33A3 Voice Record & Audio Playback Board used in the project. Applications of ESP32: The ESP32is features make it an excellent choice for a wide range of applications, Some of its Common uses include: 10T Devices: The ESP32's wireless capabilities allow it to be used in smart home systems, automation, and remote monitoring devices. Wearable Devices: Its low power consumption and small size make it ideal for wearable tech, such as fitness trackers or health monitoring devices. Smart Glove Projects: As in the Of this project, the ESP32 's versatility makes it an excellent platform for developing smart gloves that can interface with Sensors, touch inputs, and audio systems. Robotics: The ESP32 can be used in robots to control motors, sensors, and communication between different devices in a robot. Voice-Controlled Systems: With support for Bluetooth, audio Output, and additional peripherals, the ESP32 can easily integrate with speech recognition and audio playback.

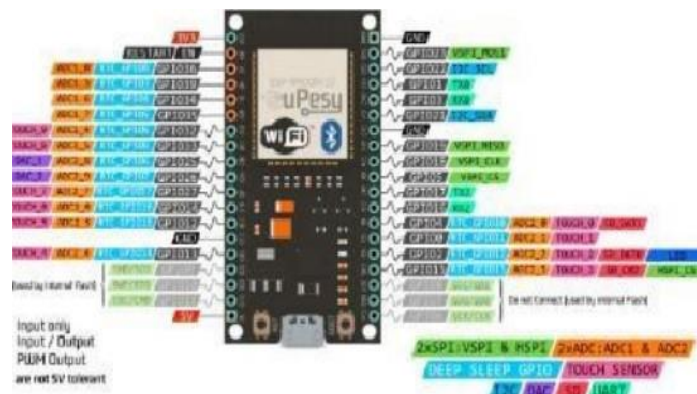


FIGURE 1. ESP32 Wroom DevKit Full Pinout

Touch Sensor Pinout:

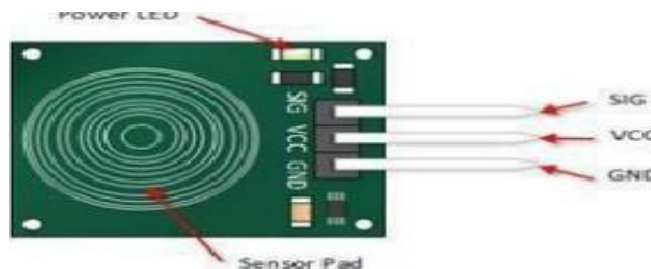


FIGURE 2. Touch Sensor Pinout Touch

GND pin needs to be connected to GND (0V), VCC pin needs to be connected to VCC (5V or 3.3v), and signal pin is an output pin: LOW when it is NOT touched, HIGH when it is touched. Working principle of Touch Sensor: Touch sensors work similar to a switch. When they are subjected to touch, pressure or force they get activated and act as a closed switch. When the pressure or contact is removed, they act as an open switch. Capacitive touch sensor contains two parallel conductors with an insulator between them. These conductor plates act as a capacitor with a capacitance value C_0 . When these conductor plates come in Contact with our fingers, our finger acts as a conductive object. Due to this, there will be an uncertain increase in the capacitance. A capacitance measuring circuit continuously measures the capacitance C_0 of the sensor. When this circuit detects a change in capacitance it generates a signal. The resistive touch sensors calculate the pressure applied on the surface to sense the touch. These sensors contain two conductive films coated with indium tin oxide, which is a good conductor of electricity, separated by a very small distance. Across the surface of the films, a constant voltage is applied. When pressure is applied to the top film, it touches the bottom film. This generates voltage drop which is detected by a controller circuit and signal is generated thereby detecting the touch. LCD Display: An LCD (Liquid Crystal Display) is a flat-screen display that uses liquid crystals to control light. It doesn't produce light on its own but uses a backlight (usually LED) behind the screen. When electricity passes through the liquid crystals, they twist to block or allow light, creating images. LCDs are thin, lightweight, and commonly used in TVs, monitors, phones, and calculators.

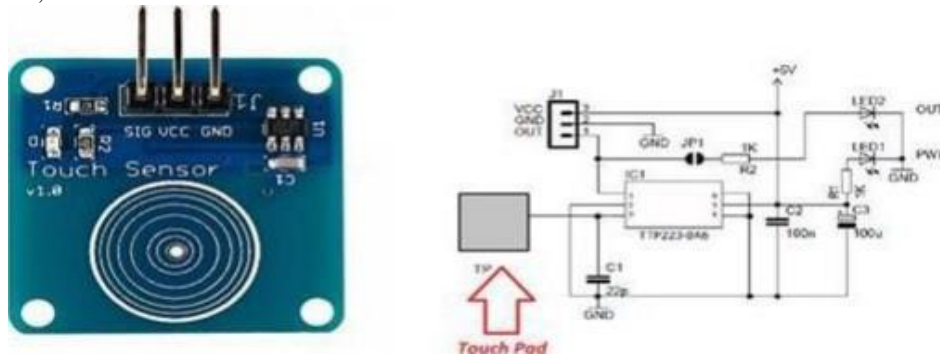


FIGURE 3. Circuit of Touch Sensor Interfacing with Arduino

Capacitor sensors are easily available and are of very low cost. These sensors are highly used in mobile phones, iPods, automotive, small home appliances, etc. These are also used for measuring pressure, distance, etc. A drawback of these sensors is that they can give a false alarm. Resistive touch sensors only work when sufficient pressure is applied. Hence, these sensors are not useful for detecting small contact or pressure. These are used in applications such as musical instruments, keypads, touch-pads, etc. where a large amount of pressure is applied. Recorder and voice playback system this voice recorder and playback system built around a recording and playback chip that supports voice recording for 16 to 30 seconds and reproduce it clearly it consist of dynamic recording and playback buttons. This can be interfaced with any micro controller and the audio output to drive a speaker. Voice 8 Channel Record/Playback APR33A3: Voice 8-Channel Record/Playback Module: The APR33A3 is a specialized audio module designed for voice recording and playback applications, offering 8 channels for storing and playing back prerecorded audio files. It is part Of the APR33A series developed by Analog Power and is commonly used in embedded systems, assistive technology, and interactive devices, such as toys, alarms, and Other voice enabled systems. In the context of the "Smart Gloves for Deaf and Dumb People" project, the APR33A3 plays a critical role in converting recognized hand gestures into audible voice messages. Key Features of the APR33A3: 8-Channel Audio Storage and Playback: The APR33A3 is capable of storing up to 8 different voice recordings (or other types Of audio), each with a corresponding channel. These recordings can represent common words or phrases that the smart gloves system needs to convey when a gesture is detected. For instance, one channel might store a greeting like "Hello," another could store "Thank you," and so on. This capability allows for a range of interactions in a compact and efficient manner. The audio is stored in non-volatile memory (such as flash storage), ensuring that the recordings are retained even when the power is turned off. High-Quality Audio Playback: The APR33A3 offers high-quality audio playback for clear and intelligible sound, which is essential for effective communication. It can produce prequalify audio with the necessary clarity for interaction in real-world settings. The module is designed to produce audio directly through speakers or a small audio output device, making it suitable for use in embedded systems and wearable devices like the smart gloves. Audio Format Support: The APR33A3 supports standard audio file formats (such as WAV or ADPCM) for voice recording and playback, ensuring compatibility with the majority Of audio files. The use of ADPCM (Adaptive Differential Pulse Code Modulation) compression is particularly beneficial for reducing the size of audio files while maintaining a reasonable level of sound quality, making it ideal for applications with limited storage space, like embedded devices. Simple Interface: The APR33A3 offers a simple interface for control, which is critical for use in embedded systems. It communicates with a micro-controller (like the ESP32) using standard protocols such as SPI (Serial Peripheral Interface) or I2C (Inter-integrated Circuit). This allows easy integration with other components in the system and straightforward control for triggering audio playback. It provides a GPIO interface for external control, enabling external systems (such as the ESP32) to send signals to the module to

initiate playback Of the audio files based on input received from sensors (in the case of the smart gloves, touch sensors detecting hand gestures). **Low Power Consumption:** The APR33A3 is designed to operate with low power consumption, which is essential for battery-powered devices like wearable smart gloves. It supports low-power modes and is energy-efficient, ensuring the overall power efficiency of the system without sacrificing performance. **Multiple Trigger Modes:** The APR33A3 supports various trigger modes for playback, including GPIO triggers and serial commands. This allows for flexible control in different applications. In the smart gloves project, the ESP32 microcontroller would send a trigger signal to the APR33A3, activating the playback of the corresponding voice message when a specific gesture is detected. **Adjustable Volume Control:** The module provides volume control, which is useful in situations where different environments (e.g., noisy vs. quiet areas) may require different sound levels. This can be managed via external circuits or the software controlling the playback, ensuring that the audio output is always audible in different settings. **Compact and Cost-Effective Design:** The APR33A3 is designed to be compact, making it suitable for integration into small devices or wearable systems. Its small form factor allows it to be embedded into gloves, toys, or other portable devices without occupying excessive space. Additionally, it is a cost-effective solution for applications that require multiple audio channels for recording and playback. **How the APR33A3 works in the smart gloves system:** In the "Smart Gloves for Deaf and Dumb People" project, the APR33A3 module plays a crucial role in providing the voice output for gestures made by the user. Here's how it fits into the overall system: **Gesture Detection:** The gloves incorporate touch sensors that detect hand gestures made by the user. These sensors send input data to the ESP32 micro-controller, which processes the gesture and determines which recorded voice message, should be played. **Triggering Audio Playback:** Once the ESP32 recognizes a specific gesture, it sends a signal to the APR33A3 module via SPI or GPIO to trigger the playback of the corresponding prerecorded voice message. For example, if the user makes a gesture for "Hello," the ESP32 will signal the APR33A3 to play the message stored in Channel 1. **Voice Playback:** The APR33A3 retrieves the appropriate audio file and plays it through a connected speaker. The speech output provides a clear, understandable message for the person, with whom the user is interacting, enabling the user to communicate without the need for vocalization. **Multiple Message Options:** By storing up to 8 different messages, the system can cover a variety of basic conversational needs, such as greetings, responses, requests, or common phrases. This ensures the user can communicate a range of messages depending on their needs at the time. **Applications of the APR33A3: Assistive Technologies:** The APR33A3 is ideal for assistive communication devices, such as the smart gloves in this project, where it helps to convert gestures or inputs into audible speech. **Interactive Toys:** The module is often used in toys to provide voice responses based on user interactions. **Voice-based Alarms:** It can be used in alarm systems that play pre-recorded voice messages for notifications or warnings. **Information Systems:** The APR33A3 is used in kiosks or other systems where prerecorded information is delivered via voice prompts, helping users in public places or facilities. **Software Implementation** The software used by the Arduino is Arduino IDE. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable Of compiling and uploading programs to the board with a single click. There is typically no need to edit make files or run on a command: line interface. Although building on command-line is possible if required with some third-party tools such as 1110. The Arduino IDE comes with a C/C++ library called "Wiring" (from the project Of the same name), which makes many common input/output operations much easier. Arduino programs are written in C/C++, although users only need define two functions to make a runnable program: setup () — a function run once at the start of a program that can initialize settings.

```

Arduino - 0011 Alpha
File Edit Sketch Tools Help
Blink
/*
 * Blink
 *
 * The basic Arduino example. Turns on an LED on for one second,
 * then off for one second, and so on... We use pin 13 because,
 * depending on your Arduino board, it has either a built-in LED
 * or a built-in resistor so that you need only an LED.
 *
 * = http://www.arduino.cc/en/Tutorial/Blink
 */

int ledPin = 13;          // LED connected to digital pin 13

void setup()             // run once, when the sketch starts
{
  pinMode(ledPin, OUTPUT); // sets the digital pin as output
}

void loop()              // run over and over again
{
  digitalWrite(ledPin, HIGH); // sets the LED on
  delay(1000);                // waits for a second
  digitalWrite(ledPin, LOW);  // sets the LED off
  delay(1000);                // waits for a second
}

Done compiling

Binary sketch size: 1096 bytes (of a 14336 byte maximum)
32

```

FIGURE 4. A screenshot of the Arduino IDE showing the "Blink" program

Simulator for Arduino: The Arduino Simulator app gives the user the freedom to work without the basic setup Of hardware and software. It is designed to be used by beginners and also, experienced developers, who want to quickly develop Arduino projects. The developer can make the necessary changes in the code - delay, pin number, and state – 0 (low) 1 (high) - and check it immediately. The app shows the breadboard, complete with 14 LED pins. You can drag and place the wires in the correct positions to connect to Arduino. If the wires are placed according to the code, then it will show the expected results. Once satisfied, you can save it and email it. The code can be copied and used in an actual project just as easily. This app is an easy way to work through Arduino projects. With customizable codes, and a simple to use interface, this Arduino Simulator app from Schogini Systems is a convenient app for Arduino developers. A screenshot of Arduino simulator is shown in the figure below:



FIGURE 5. Screenshot of ARDUINO simulator

IOT: The Internet of Things (IOT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and fields of embedded systems, wireless sensor networks, control systems, and others all contribute to enabling the Internet of Things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart speakers. There are a number of serious concerns about dangers in the growth of IoT, and consequently industry and governmental moves to begin to address these. Security: Security is the biggest concern in adopting Internet of things technology 1801 with concerns that rapid development is happening without appropriate consideration of the profound security challenges involved and the regulatory changes that might be necessary. Most of the technical security concerns are similar to those of conventional servers, workstations, smart phones and include weak authentication, forgetting to change default credentials, unencrypted messages sent between devices, SQL injections and poor handling of security updates-However, many IoT devices have severe operational limitations on the computational power available to them. These constraints often make them unable to directly use basic security measures such as implementing firewalls or using strong cryptosystems to encrypt their communications with other devices and the low price and consumer focus of many devices makes a robust security patching system. Internet of things devices also have access to new areas of data, and can Often control physical devices, so that even by 2014 it was possible to say that many Internet-connected appliances could already "spy on people in their own homes" including televisions, kitchen appliances, cameras, and thermostats. Computer-controlled devices in automobiles such as brakes, engine, locks, hood and trunk releases, horn, heat, and dashboard have been shown to be vulnerable to attackers who have access to the on-board network. In some cases, vehicle computer are Internet-connected, allowing them to be exploited remotely. By 2008 security researchers had shown the ability to remotely control pacemakers without authority. Later hackers demonstrated remote control of insulin pumps and implantable cardioverter defibrillators. The U.S. National Intelligence Council in an unclassified report maintains that it would be hard to deny "access to networks of sensors and remotely-controlled objects by enemies of the United States, criminals, and mischief makers... An open market for aggregated sensor data could serve the interests of commerce and security no less than it helps criminals and spies identify vulnerable targets. Thus, massively parallel sensor fusion may undermine social cohesion, if it proves to be fundamentally incompatible with Fourth-Amendment guarantees against unreasonable search In general; the intelligence community views the Internet of Things as a rich source of data. There have been a range of responses to concerns over security. The Internet of Things Security Foundation (IOTSF) was launched on 23 September 2015 with a mission to secure the Internet of Things by promoting knowledge and best practice. Its founding board is made from technology providers and telecommunications companies. In addition, large IT companies are continuously developing innovative

solutions to ensure the security for IoT devices. Governmental regulation is argued by some to be necessary to secure IoT devices and the wider Internet — as market incentives to secure IoT devices is insufficient. IoT systems are typically controlled by event-driven smart apps that take as input either sensed data, user inputs, or Other external triggers (from the Internet) and command one or more actuators towards providing different forms Of automation. Examples Of sensors include smoke detectors, motion sensors, and contact sensors. Examples of actuators include smart locks, smart power outlets, and door controls. Popular control platforms on which third-party developers can build smart apps that interact wireless with these sensors and actuators include Samsung's Smart Things. A problem specific to IoT systems is that buggy apps, unforeseen bad app interactions, or device/communication failures, can cause unsafe and dangerous physical states, e.g., "unlock the entrance door when no one is at home" or "turn off the heater when the temperature is below 0 degrees Celsius and people are sleeping at night".-Detecting flaws that lead to such states, requires a holistic view Of installed apps, component devices, their configurations, and more importantly, how they interact. Recently, researchers from the University of California Riverside have proposed IoTSan, a novel practical system that uses model checking as a building block to reveal "interaction-level" flaws by identifying events that can lead the system to unsafe states.

Testing: Communication is one of the most essential aspects of human interaction, serving as the foundation of understanding and building relationships. However, for individuals who are deaf or mute, traditional forms of communication, such as speech and listening, are often inaccessible. This limitation can create significant barriers in daily life, affecting education, employment, social interactions, and overall quality Of life. Despite the advancements in assistive technologies for people with disabilities, there remains a significant gap in enabling seamless communication for the deaf and mute community. In recent years, technological innovation has introduced several solutions that aim to bridge the communication divide. One such approach involves the development of smart gloves that can interpret hand gestures and convert them into audible speech. These smart gloves hold the potential to empower individuals with speech and hearing impairments, allowing them to communicate more effectively in real-time with those who may not understand sign language or other of non-verbal communication. By utilizing modern electronics, microcontrollers, and voice synthesis technology, such gloves can revolutionize communication methods for individuals who are deaf or mute.

This project, titled "Smart Gloves for Deaf and Dumb People," proposes a practical solution that integrates the use of an ESP32 micro-controller; touch sensors, and an APR33A3 Voice Record & Audio Playback Board to create a system capable Of translating hand gestures into speech. The system aims to facilitate communication by recognizing specific gestures and playing corresponding prerecorded voice messages through the APR33A3 audio playback system. This combination of hardware and software makes the gloves a potential breakthrough in assistive technology for individuals with speech and hearing impairments. The core of the project revolves around the use Of the ESP32, a powerful, low-cost micro-controller with integrated Wi-Fi and Bluetooth capabilities. This micro-controller serves as the heart of the system, processing the data from the touch sensors embedded in the gloves. The touch sensors are designed to detect specific hand gestures, such as finger movements or configurations, which are then sent to the ESP32 for processing. Once a gesture is recognized, the micro-controller sends a signal to the APR33A3, an advanced 8-channel voice record and audio playback module, to output the corresponding prerecorded message. These messages are stored on the APR33A3 board and cover various phrases or words typically used in daily conversations, such as greetings, requests, and common expressions. The use of the APR33A3 Voice Record & Audio Playback Board is crucial in providing a seamless and clear audio output. The APR33A3 is equipped with the capability to store multiple audio files (up to eight different recordings in this case), which can be triggered by the ESP32 based on the detected gestures. This enables the system to communicate a wide range of responses and allows users to express themselves with the same ease as speaking individuals. The integration of this technology into wearable gloves also ensures that the system is portable, allowing users to take it with them wherever they go, providing a flexible and convenient solution for on-the-go communication. The main objective of this project is to empower individuals with hearing and speech impairments by providing a practical and reliable method of communication. The smart gloves can serve as a bridge, translating hand gestures into understandable speech that anyone, regardless of their familiarity with sign language, can comprehend. In doing so, the project aims to reduce the social isolation often experienced by deaf and mute individuals and promote inclusive by enabling easier interaction with the hearing world. Key Features of the Smart Gloves System:

ESP32 Micro-controller: The ESP32 micro-controller provides the processing power needed for the system. It is responsible for interpreting the input from the touch sensors, making decisions based on the recognized gestures, and sending appropriate signals to the APR33A3 audio playback module. Additionally, the ESP32 can communicate wireless, offering potential future upgrades for remote access or cloud connectivity if needed.

Touch Sensors: Touch sensors are integrated into the gloves to detect specific hand gestures. Each gesture corresponds to a specific output, such as a greeting or request. The sensors are designed to be sensitive yet accurate, ensuring that even subtle movements can be detected. By placing these sensors in key areas of the gloves (e.g., fingertips and palms), the system can identify complex gestures or simple finger movements.

APR33A3 Voice Record & Audio Playback Board: The APR33A3 is a vital component that allows for the conversion of hand gestures into understandable speech. This module can store multiple voice recordings and plays the appropriate message when triggered by the ESP32 micro-controller. The board's ability to store up to eight different recordings makes it suitable for a wide range of phrases and words that a user may need for day-to-day communication.

Speech Output: Once the ESP32 processes the gesture, the corresponding voice message is played through the APR33A3, providing audible speech. This allows individuals with speech and hearing impairments to communicate with

others without requiring special knowledge of sign language. Impact and Potential of the Project: The development of smart gloves for deaf and mute individuals has the potential to improve social integration and ease of communication for this group. It opens up new avenues for users to engage in conversations in a variety of settings, whether in a professional, educational, or personal context. This innovation can be particularly valuable in environments where sign language is not widely understood, enabling smoother interactions with people who may not be familiar with traditional communication methods. Moreover, the project demonstrates the power of combining wearable technology with speech synthesis, highlighting the growing potential of assistive devices that help overcome the limitations of physical disabilities. The system not only aids in communication but also fosters a greater sense of independence and autonomy for users, allowing them to express confidently and freely.

4. RESULT



FIGURE 6



FIGURE 7



FIGURE 8

5. CONCLUSION

The no. of disabled people like deaf and dumb are increasing day by day and it is found that the device used to assist them are very expensive and not much effective for all. Most of them can't afford the price so they spend their whole life in a single room. This product is very cost effective and user friendly and the main advantage of this product is the device is portable that means they can go anywhere and communicate with others easily. so the device help them to live a free life in the society without the help of a third person. This device is very helpful for both deaf-dumb and physically disabled people. By introducing the Smart Hand Gloves for Disable People, It will provide the more reliable, efficient, easy to use and light weight solution to user as compare to other proposed methods. This will responsible to create meaning to lives of disable people.

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