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Sign E-Glove

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Abstract*: Speech is the easiest way to communicate 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 a normal person, the bridge gap between speech-impaired and normal masses is too much to fill. Gesture recognition can be done in two ways, Image processing-based, and sensor-based. The objective of the project is to design a smart glove for sign language translation that helps an easy way of communication for speech- impaired or hearing-impaired people. In this project, gloves need to be equipped with sensors such as Flex sensors which sense different sign language gestures. Flex sensors are placed on fingers that measure the bending of fingers according to a gesture made. The sensed data from sensors is sent to ESP32 microcontroller board for further processing and the data we get will be displayed on LCD display in the form of text. This text data is then converted into speech through APR module and audio will comes out through speaker. During emergency conditions, push button on the gloves needs to be pressed by disabled person such that ESP32 will send a message called "Emergency" to the normal person's phone through Wi-Fi. Since it is a duplex mode model, the normal person can send some messages by Blynk App to the disabled person and ESP32 captures the messages and display them in LCD display*

Keywords: MSME, Finance, Marketing, Economy, Growth, Employment, Marketing, Export

I. INTRODUCTION

In the modern society, it is exceedingly difficult for persons who are dumb or deaf to communicate with regular people since they lack the conveniences that a normal person should have. The same issue arises when two people speak two different languages and cannot communicate with one another without the physical assistance of a translator, whichmay not always be convenient to arrange. A similar issue arises when a normal person and a deaf or dumb person are in close proximity to one another. Even though technology has advanced quickly in this information age, sign language remains the only mode of communication for deaf/mute persons. When connecting with other people outside of the sign language community, the use of sign language as a tool canbe helpful for individuals who are familiar with it. The best option for allowing deaf/mute persons to converse fluently in several languages through technology is a sign language translator. As a formal language, sign language uses a system of hand gestures to facilitate communication (by the deaf). For the automatic interpretation of the gesture languages used by the deaf people, many projects utilised glove-based systems. The systems created for these projects varied in terms of factors like the quantity of classifiable signs, which may be anywhere between a handful and thousands, thesorts of signs, which could be static or dynamic, and the proportion of correctly categorized signs.

Hand movement data acquisition is used in many engineering applications ranging from the analysis of gestures to biomedical sciences. One of the most significant initiatives targeted at gathering information on hand mobility is glove-based systems. While they have been around for over three decades, they keep attracting the interest of researchers from increasingly diverse fields. Glove-based systems, the most common devices for handmovement acquisition, have been under development for about 30 years, and a rising numberof researchers are still involved in this work. We chose to study the glove systems for sign language understanding. All are not deaf and mute, thus we use the labels hearing challenged and mute instead. Withthe development of modern hearing aid technology, some people can speak. They show individuals with various disabilities affection, tolerance, and compassion. This project is proposed specifically to help the blind, deaf and dumb so that they can interact with other people. System of intelligent hand gloves that can reduceobstacles for people with disabilities. For persons who are deaf or dumb who use sign language to communicate with others, our initiative will translate hand gestures.

II. LITERATURE SURVEY

[1] "Sign Language Recognition using Image Processing" , 2017 by K.P. Kour and L.Mathew. uses the SURF (Speed up Robust Features) technique for image processing. Video camera is used to record hand movements, and the input video is partitioned into frames, for each frame, a set of features are extracted. The system is implemented in MATLAB.

[2] ""Image Processing for Sign Language Recognition" , 2018 by Rahul Dolas,Dnyaneshwari Mane, Vaibhav Thakare, and Vijay More. The concept put out in this paper is a smart glove that can output speech in sign language. The glove is integrated with flex sensors and an Inertial Measurement Unit (IMU) to recognize the gesture. The system will process the user's provided image, extract features from it, match it with informational images, and return the results.

[3] By Rabin Gupta, Prabhat Mali, and Mayank K. Gurung, "Smart Glove for Sign Language Translation Using Arduino" , 2018. This project consists of a glove with sensors that canrecognise various sign language gestures. Data from these sensors is fed to an Arduino board, which then transmits it.

[4] "A Glove Based Approach to Recognize Indian Sign Languages" , 2019 by N. Krishnaraj,M. G.Kavitha, T. Jayasankar, K. Vinoth Kumar. This piece of work serves as anexample of vision-based concepts with a camera. The indications would be gathered and captured by a webcam as usual, and then they would go through several stages of preparation. The preprocessing procedure's mechanism involves removing the skin pixels and applying the appropriate morphological filtering. Here, the recognised indicators are transmitted to a ZigBee transmitter. A ZigBee receiver o the other side would adequately receive the signs from the transmitter. The microcontroller transmits signals to the display device.

[5] 2020's "Sign To Speech Smart Glove" [8] by Nidhi Patel, Pradnya Padmukh, and KhushbuPal.Gloves are used in this study to record a disabled person's hand motion and translate it into text and speech. To record the user's movements, a pair of gloves with flex sensors along each finger, thumb, and arm, contact sensors, and an accelerometer are used. Flex sensors are used to calculate the voltage values of the angles of the fingers, thumb, and arm.This voltage information is then entered into the comparator circuit to convert it from analogue to digital. Arduino is used for the processing of the entered data and decides the outputted word or letter. The letter or word that the Arduino produces get transferred to thephone that the other person (listener) is using. The phone has an android application designed by the team that present our outputted word or letter in the shape of voice and text.

[6] A survey titled "Smart Glove for the Disabled" [9], 2021 by Hrishikesh P Athreya, G. Mamatha, R.Manasa, Subhash Raj and R. Yashwanth. The gesture recognizer's potential tobe an independent system placed in a typical living environment is one of this project's mostimportant characteristics. This technique converts the language into an associate passing voice which is easily understandable by blind and common people. The language istranslated into some text and it is displayed on the digital display screen, to allow the deaf individuals.

III. OUTCOME OF LITERATURE SURVEY

By referring papers and journals related to the project, the outcome for the literature survey is as follows it can conclude that many surveys had been done on ign E-glove

- Each one of the works mentioned above has its drawbacks and weaknesses.
- The final vision of these papers is to help disabled persons by developing glovesusing different techniques.
- Cost effective, portable, reliable, and less complex developing steps are the keys thatneed tobe focused.
- Develop a Full duplex Interface

IV. PROBLEM STATEMENT

Developing a full duplex mode communication model that enables effective communication between a normal person and speech or hearing aided person by conversion of sign language to general English language.

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V. METHODOLOGY

5.1 Proposed Model

The Sign E Glove project aims to provide an affordable and portable communication device for individuals with speech and hearing impairments, thereby improving their quality of life and expanding their social and educational opportunities. The gloves used in the Sign E Glove project are equipped with flex sensors on each finger, excluding the thumb. These sensors detect resistance changes based on the bending angles of the fingers. The analog voltage signals generated by these sensors are sent to the ESP32 microcontroller board through a voltage divider circuit connected to an analog port. The ESP32 board processes the sensor data and selects the corresponding output word or letter based on the gestures made by the user. Once the data is processed, it is transformed into voice using an Automatic Voice Recognition (APR) module. Simultaneously, the text representation of the gestures is displayed on an LCD screen, providing a visual reference for communication. The audio output is played over a speaker, allowing others to hear the user's message. In the case of an emergency, the Sign E Glove includes a button that, when pressed by the disabled person, triggers the ESP32 board to send a labeled "Emergency" message to a designated phone over Wi-Fi. This capability enables individuals with disabilities to quickly contact and request assistance in urgent situations, enhancing their safety and well-being.

Additionally, the Sign E Glove integrates the Blynk App, which can be accessed by the ESP32 board and displayed on the LCD screen. This feature allows a normal person to use the glove's duplex mode to convey messages to the disabled individual. The duplex mode enables two-way communication, facilitating interaction between the impaired person and others. By incorporating this functionality, the Sign E Glove project aims to improve the communication skills of individuals with disabilities and enhance their ability to interact successfully with others. In summary, the Sign E Glove project aims to provide an affordable, portable, and intuitive communication solution for people with hearing and speech impairments. By simplifying and improving their ability to communicate, this project seeks to enhance their overall quality of life by expanding their social, educational, and professional opportunities.

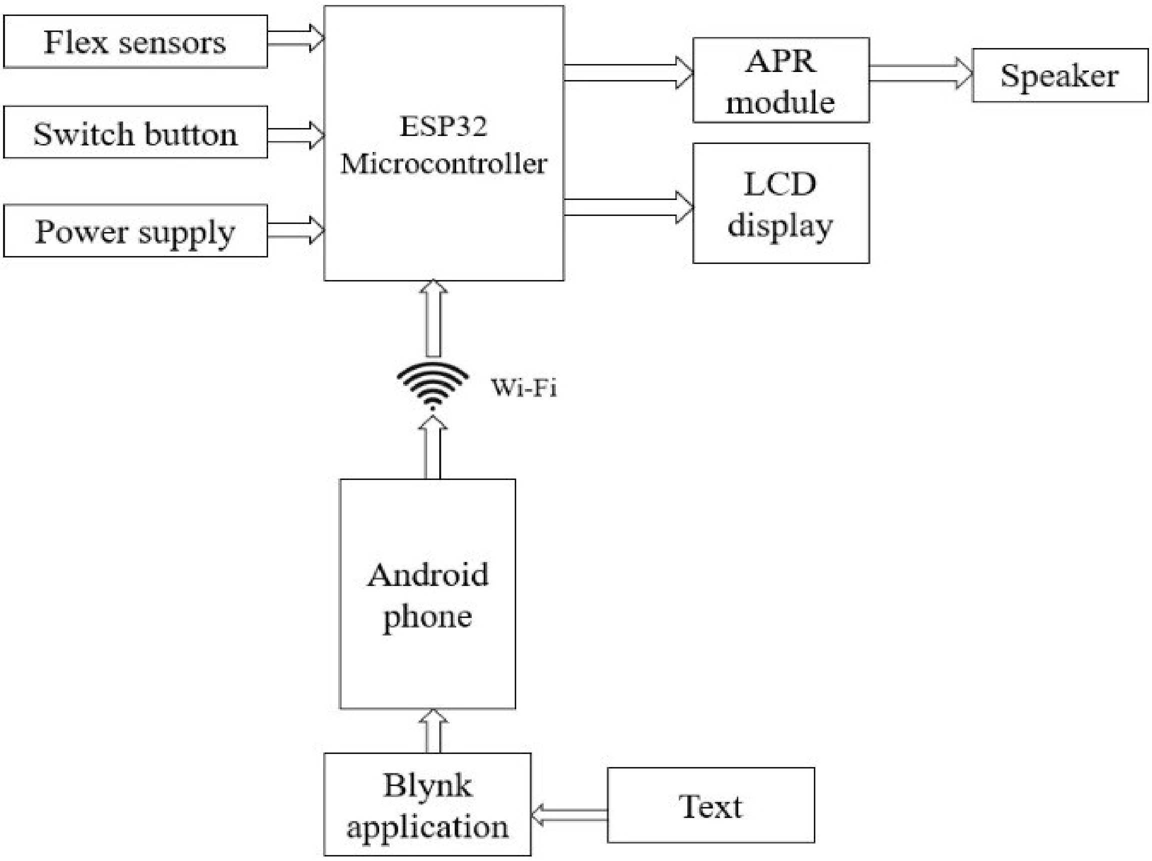

Fig 1: Block Diagram

VI. HARDWARE AND SOFTWARE REQUIREMENTS

6.1 Flex Sensor

A bend sensor, sometimes known as a flex sensor, is a simple, affordable sensor made specifically to gauge how much something is deflecting or bending. It rose to fame in the 1990s as a result of its employment as a gaming interface in the Nintendo Power Glove. Since then, it has been used as a pressure sensor on robotic grippers, a door sensor, a bumper switch for wall detection, and a goniometer to measure joint movement. In essence, a flex sensor is a variable resistor that changes resistance in response to bending.It is frequently referred to as a Flexible Potentiometer since the resistance is exactly proportional to the degree of bending. Flex sensors are frequently employed in robotics, medical technology, and wearable electronics. Flex sensors are employed in the Sign E Glove project to record the bending angles of the fingers in order to recognise hand gestures performed by the impaired person and translate those motions into text and spoken output. This resistance is around 25k whenthe sensor is straight, as seen in fig 2

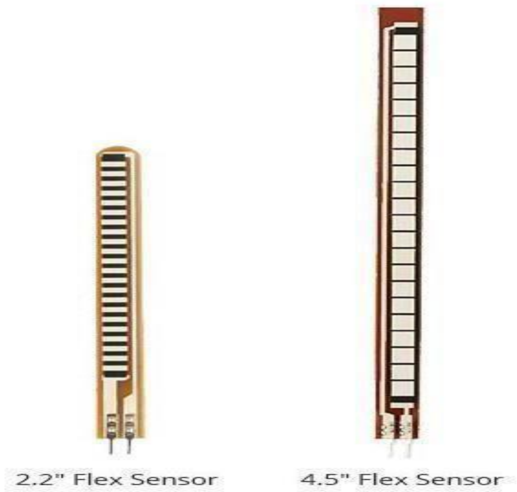

Fig 2: flex Sensors

6.2 ESP 32 Module

The Espressif Systems-developed ESP32 is a potent, reasonably priced, and energy-efficientmicrocontroller, as depicted in Figure 3.3.2. It is the perfect platform for Internet of Things(IoT) applications because it is built on a dual-core Tensilica LX6 processor with a clock speed of up to 240 MHz and includes Wi-Fi and Bluetooth connectivity. The highly integrated architecture of the ESP32 microcontroller contains a processor, memory, and a number of peripherals. It has two Tensilica LX6 cores that can multitask andexecute high-performance processing, each with its own memory subsystem. The microcontroller includes 16 MB of flash memory and 520 KB of SRAM, both of which canbe utilised to store data and application code. A wide range of peripherals, including numerous interfaces for communicating with external devices, are also available for the ESP32. There are 18 GPIO pins available for connecting to sensors and actuators. Additional UART, I2C, SPI, and SDIO interfaces are available forconnecting to additional microcontrollers, sensors, and external memory systems. It also includes integrated analog-to-digital converters (ADC) and digital-to-analog converters (DAC) that can be utilised to connect to analogue sensors and actuators. The Bluetooth connectivity supports both master and slave modes and is based on the Bluetooth Low Energy (BLE) standard. The BLE module offers up to 1 Mbps data rates andcan operate in the 2.4 GHz frequency spectrum. Additionally, Bluetooth Classic is supportedby the ESP32, allowing you to connect to older devices. Additionally, the ESP32 contains an integrated low-dropout (LDO) regulator that can lower the voltage from an external power source to the level needed by the microcontroller. Additionally, it offers a deep sleep mode that can further cut down on power usage by turningoff the Bluetooth and Wi-Fi components.

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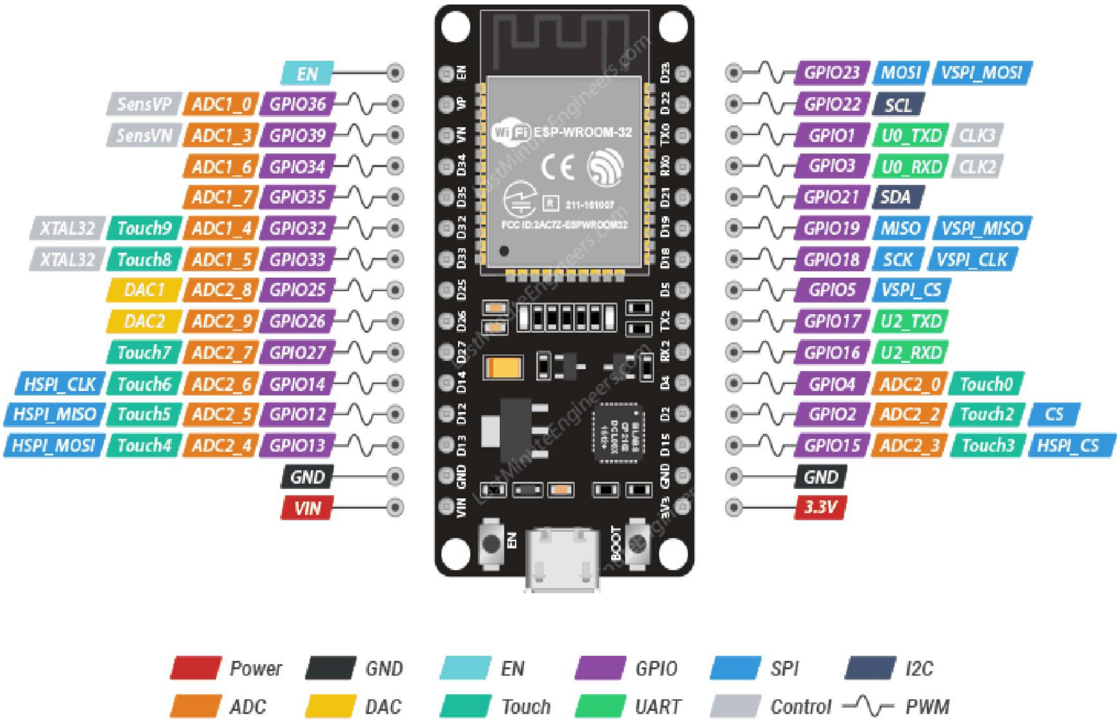

Fig 3: ESP 32 Module

6.3 Switch Buttons

The push button switch is a common type of control switch appliance that is used to turn onand off the control circuit. A push button switch, often referred to as a momentary switch, is a kind of switch made to only work when the button is pressed. The switch returns to its initial position after the button is released, breaking the circuit and stopping the flow of current. Push button switches are frequently used to operate various operations, such as turning on and off a device, choosing an operating mode, or setting off an alarm, in electronic devices,control panels, and industrial applications. A push button switch's three main components are a button, contacts, and spring. When thebutton is pressed, the contacts, which are frequently formed of metal, are intended to come together, allowing current to flow through the circuit. The spring separates the contacts whenthe button is released, completing the circuit and halting the flow of current. To fit various applications, push button switches can be found in a range of sizes, shapes, and button colours. Additionally, they may have various contact types, such as ordinarily open (NO) or usually closed (NC) contacts, which define the state of the switch.

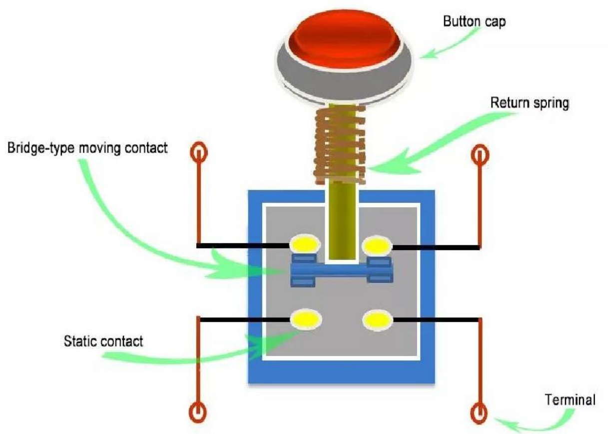

Fig 4 : Switch buttons

6.5 APR module

The APR33A3 is an 8-channel voice record and audio playback board that incorporates theAPR33A series IC, a potent audio processor, together with high-performance audio ADCs and DACs. Along with high-performance analog-to-digital converters (ADCs) and digital-to-analog converters (DACs), the APR33A series is a potent audio processor. The IC is a completely integrated solution that combines analogue input, digital processing, and analogue output functionality with high performance and unmatched integration. The APR33A series was created specifically for the straightforward key trigger. A switch allows the user to record and play back audio messages for an average of 1, 2, 4, or 8 times.The sampling rate may also be changed by changing the value of the resistors. It is appropriate for a simple user interface or when the length of a single message needs to be limited, for example, in toys, leave messages systems, answering machines, etc.

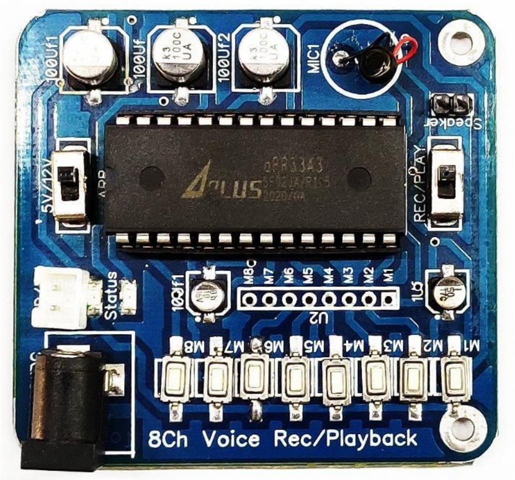

Fig 5 : APR33A3 board

6.6 LCD Display Module

Liquid Crystal Display (LCD) is widely used in various electronics' applications. It is commonly used in various systems to show different status and parameters. LCD16x2 has 2 lines with 16 characters in each line. Each character is made up of 5x8 (column x row) pixel matrix.

Fig 6: LCD Display Module

6.7 Speaker

Multimedia speakers, are speakers sold for use with computers, although usually capable of other audio uses, e.g. for an MP3 player. Most such speakers have an internal amplifier and consequently require a power source, which may be by a mains power supply often via an AC adapter, batteries, or a USB port. The signal input connector is often a 3.5 mm jack plug (usually color-coded lime green per the PC 99 standard); RCA connectors are sometimes used, and a USB port may supply both signal and power (requiring additional circuitry, and only suitable for use with a computer). Battery-powered wireless Bluetooth speakers require no connections at all. Most computers have speakers of low power and quality built in; when external speakers are connected they disable the built-in speakers. Computer speakers sometimes packaged with computer systems are small, plastic, and have mediocre sound quality. Some computer speakers have equalization features such as bass and treble controls. Bluetooth speakers can be connected with a computer by using an Aux jack and compatible adaptor.

Fig 7: Speaker

6.8 Software Requirements

A. Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, mac OS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching, and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one clicks mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main () into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. From version 1.8.12, Arduino IDE windows compiler supports only Windows 7 or newer OS. On Windows Vista or older one gets "Unrecognized Win32 application" error when trying to verify/upload program. To run IDE on older machines, users can either use version 1.8.11, or copy "Arduino-builder" executable from version 11 to their current install folder as it's independent from IDE.

Fig 12: Arduino IDE

VII. EXPECTED OUTCOME

The Smart-Glove is a revolutionary communication device designed to support blind and deaf-blind individuals in interacting with people who are not familiar with Braille. This device enables seamless messaging between Smart-Glove and an Android mobile application, facilitating efficient communication. The Smart-Glove features a lightweight design that prioritizes user comfort. It is affordable, making it accessible to a wide range ofindividuals, and its user-friendly interface ensures ease of use without any associated risks.With the Android mobile application, users can send and receive text messages to and from Smart-Glove. The application acts as an intermediary, translating the text messages into Braille and vice versa. This functionality allows deaf-blind individuals to communicate effectively with their families, friends, and people in their surroundings.

7.1 Blynk Application

With the help of the new platform Blynk, you can easily create user interfaces for iOS and Android devices to control and monitor your hardware projects. You can design a project dashboard after downloading the Blynk software and placing buttons, sliders, graphs, and other widgets on the screen. The Blynk platform's main goal is to make creating mobile phone applications incredibly simple. You'll learn in this course that creating a mobile application that can communicate with your Arduino is as simple as dragging a widget andsetting up a pin. With Blynk, it is possible to operate a motor or LED from a mobile devicewith essentially no programming. For use with the Internet of Things, Blynk was created.

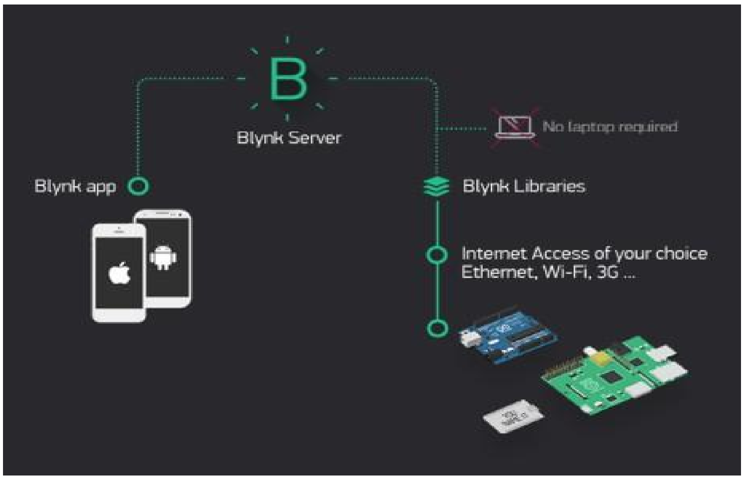

Fig 9: Blynk application

VIII. CONCLUSION

In today's world, speech is the most common and convenient means of communication. However, for speech-impaired or hearing-impaired individuals, communicating with the general population can be a significant challenge. Sign language is often used as analternative form of communication, but it requires the presence of someone who understands and can interpret it. This creates a significant gap between speech-impaired individuals andthe rest of society. To bridge this communication gap, the project aims to design a smart glove for sign languagetranslation. By incorporating various technologies such as sensors, microcontrollers, displays, audio processors, and wireless communication, the system provides an innovative solution for speech-impaired individuals to express themselves and understand others more effectively. The smart glove for sign language translation represents an exciting and promising advancement in assistive technology. Its integration of sensors, microcontrollers,displays, audio processors, and wireless communication enables speech-impaired individuals to communicate

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