SMART GLOVE FOR SIGN LANGUAGE TRANSLATION FOR DISABLED PERSON

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Abstract- In India alone, a substantial percentage of people are stupid or deaf. In order to translate sign language (ASL) to speech, the system is creating a glove-based device. The recognition of sign language and its subsequent conversion to text and voice are the two parts of the basic system. A simple hand glove with flex sensors inserted to measure the degree of finger bending makes up the sign language glove. Flex, which is an acronym for bend, describes the resistance changes that the sensors can make in response to a specific degree of bend. The Arduino Nano control unit receives sensor input, which is digitally transformed from analog to digital and compared with a stored value to identify indications. On the 16x2 LCD, the findings are displayed as text. Furthermore, test-to-speech software is installed on a PC or mobile device to which the text output is wirelessly transmitted. We are currently working on a simple prototype that can translate simple numeric and alphabetic characters. After that, word recognition will be added.

Key words: Dumb, Sound Glove, Arduino, ASL, Deaf, Flex, and Gesture Recognition.

INTRODUCTION

Sign language is an innate communication tool used by both normal and dumb people. Recognizing hand gestures is essential to most sign language apps. For common people, it might be challenging to understand the meaning conveyed by signs and to read them. Consequently, the goal of the gloves is to facilitate the lives of the hard of hearing and dumb. With the gloves, normal individuals can read gestures, hear voices, and understand what is being said by converting hand movements into text and subsequently speech. As a result, communication is more effective. Both tangible and non-physical communication occur within the system. The sign language used differs and is not universal between countries. It was in America that American Sign Language (ASL) and British Sign Language were developed, respectively. Most countries utilize American Sign Language, which is also the foundation of our system. The system's core, Arduino, is used by the gloves to convert certain motions from text to speech. The glove-mounted system translates gestures into resistance using flex sensors, which the Arduino Nano subsequently converts into text. There is enough flexibility in the family of flexible sensors that includes the flex sensors. In addition to flex sensors, accelerometers and touch sensors are also used to produce correct output. The accelerometer is used to monitor the hand's motion and the locations where the fingers make contact. The selection of sensors is based on the language's words. Some signals depend on movement of the palm; such signals are monitored by an accelerometer; other signals depend on touch of the finger; contact sensors are used to measure

the exact output in these situations. To create text that appears on an LCD, the Arduino Nano processes the sensor's data. Moreover, a Bluetooth module is used to convey that text to PCs and smartphones. Additionally, such data is converted into speech using text-to-speech software. A product that translates sign language into spoken language is not available for purchase. However, efforts are underway to develop a portable, accurate, and efficient sign-to-speech technology.

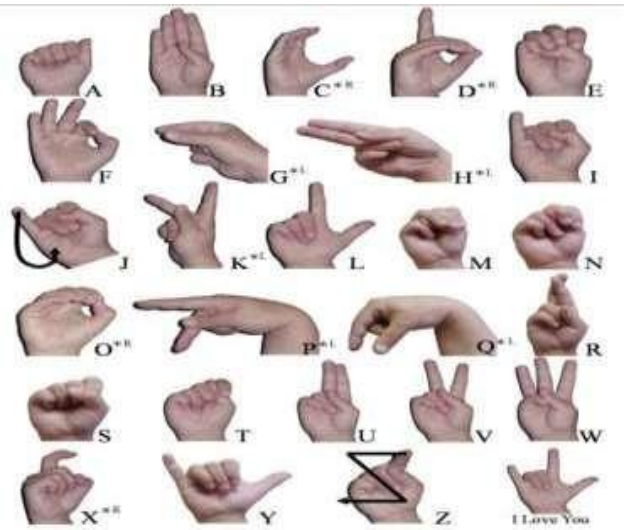

Figure 1: American Sign Language[7]

LITREATURE REVIEW

University of Georgia students Thomas Pryor and Navid Azodi invented the sign aloud gloves, which translate sign language into text and speech. I was inspired to design my own system for the good of society when they were granted

After the output has been processed, it is delivered via Bluetooth to an Android

the Lemelson-MIT Student Prize for this effort. The firsthand Talk glove was invented by Ryan Patterson in 2001. Since it needed a computer or laptop to work constantly, this version was less portable. Writing in 1620, Juan Pablo Bonet—who also wrote R, education of letters, and art for teaching mute folks to talk wrote the first modern book on phonetics in sign language. This paper described a manual alphabet and oral instruction method for the deaf community.

PROPOSED METHODOLOGY

A) Block Diagram

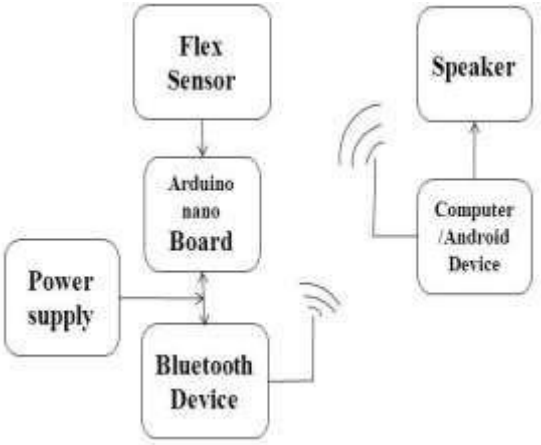

Figure 2: Block Diagram

An overview of the system's general operation is provided by the block diagram shown in the picture. It illustrates how the various project working units are arranged and ranked overall. The user utilizes American Sign Language (ASL) to create movements while wearing a glove with flex, accelerometer, and touch sensors sewed into it. An Arduino Nano receives signals from the glove's accelerometer and flex sensors. smartphone or a PC, where test to speech software (application) is loaded and speech

output is generated. The text output is then shown on the LCD.

B) Flow Chart

The figure above shows the algorithmic flow of the system. The sign language gloves are sewed with five flex sensors—one for the thumb, index, middle, ring, and pin key fingers—a touch sensor, and an accelerometer to detect exact finger motions. Each flex sensor is initially powered on by a voltage, and when the fingers move, the resistance varies, causing the flex sensors to bend and resulting in a voltage drop. There will be an Analog voltage as a result. This Analog voltage is then converted to a digital voltage using an Arduino Nano-based Analog to digital converter (ADC).

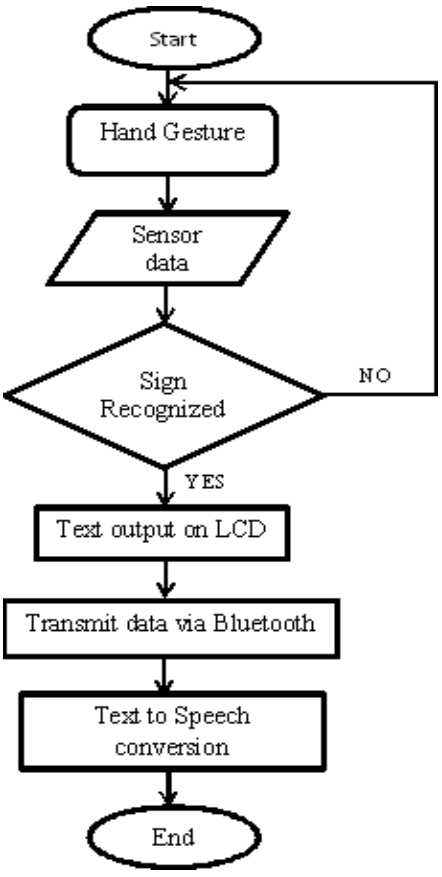

Figure 3: System Flow Chart

The digital output is then contrasted with the preloaded alphabet and numeric data from the sensor within the system. The movements are detected if the digital output matches the preloaded values. The compared output is then shown on the LCD as text, which makes it easier for the typical person to read and understand. Furthermore, the identical output is transmitted via a Bluetooth module, after which it is transmitted to an Android smartphone or a PC connected to the module. These gadgets have applications or software for converting text to speech (TTS). The program that makes advantage of the speakers' speech output displays a text output once the linked device receives the serial input via the Bluetooth link. This will enable normal people to read the output or listen to the audio and understand the gesture, which will help in communication with the deaf and dumb.

COMPONENTS USED

A) Flex Sensor

Flexible sensors, or "flex sensors," are ones that, depending on how they are bent, alter their resistance. Resistance increases with increasing bent.Flex sensors also have the ability to be adjusted analog voltage dividers. A flexible, thin substrate enclosing a carbon resistive element is what makes up a flex sensor. When the substrate is bent, the resistive element produces an output that is resistive in relation to the bend radius. Five flex sensors are incorporated within the gloves' fingers, strategically placed there because the fingers are the main component of gestures. Because every finger needs a different sensor, this is required. Bending each finger is the American Sign Language symbol for the hand motion that is input via the flex sensors. In sync with the flexion of the fingers, the resistances adjust in response to the bending of the sensors. We send this resistance value to the Arduino Nano.Accelerator (ADXL-338).

Figure 4: - Flex Sensor

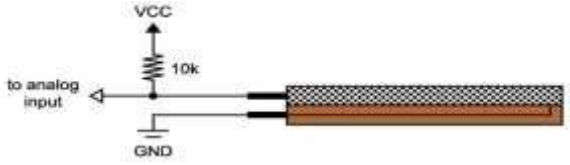

Figure 5: Voltage Divider (Flex Sensor connection)

- Thin, low-power, and small in size is the accelerometer. There are three axes on an accelerometer: X, Y, and Z. The accelerometer's change in location modifies the outputs of the X, Y, and Z axes, and the gesture is identified depending on the output of that axis. The sensor in tilt-sensing applications measures both the dynamic acceleration caused by vibration and motion, as well as the static acceleration of gravity. An array of Polysilicon surface micromachined structures sits above a silicon wafer, forming the accelerometer. The sensor measures the lateral displacement of the surface and outputs the lateral displacement along a given axis. The accelerometer is a wrist-worn device used to measure bending.
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- An accelerometer and Arduino are linked.
- An Arduino Analog pin is connected to the output pin.
- Vin pin on Arduino is linked to 3.3V pin.
- On an Arduino, the GND pin is linked to the ground pin.

Figure 6: ADXL-338

B) Liquid Crystal Display (LCD)

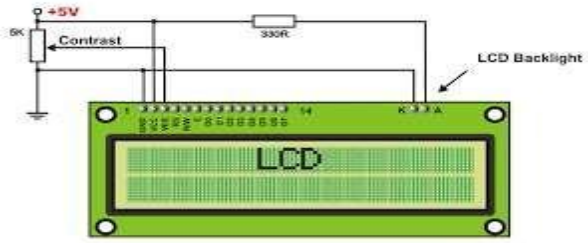

Figure 7:- LCD

The device displays 16 characters using a 16x2 LCD (Liquid Crystal Display). Every line displays eight characters. Next, each character is split up into a 5 by 7-pixel matrix. The data register and the command register are the two registers that come with the LCD. While the data register holds information to be displayed on the LCD screen, the command register is used to send commands to the LCD. Using a 10k pot that is connected to the LCD's V0 pin provides an additional method of adjusting the screen's brightness. Depending on the requirements of the system, the LCD can function in either 4-or 8-bit mode. Module for Bluetooth (HC 05).

Figure 8: HC-05

The Bluetooth module on Arduino can be used to send text data to a computer or mobile device. The Bluetooth module sends serial data to the target device, which displays it on its screen. Among the data transmitted to the Bluetooth module are the alphabets and various numerical values. The target device utilizes voice recognition software after receiving this data in a serial form and displaying the result.

C) Arduino Nano

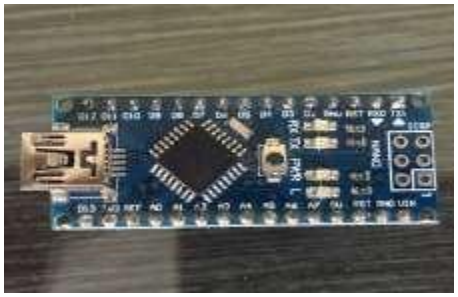

Figure 9: Arduino Nano Board

Arduino is a project, company, and user community that designs and produces computer hardware and software kits. Its goal is to develop interactive objects and digital devices that have the ability to sense and sense their actual surroundings.

D) MIT App Inventor

Applications for Android smartphones are prepared using this software. The inventor application contains every feature one might possibly want from an Android phone, including buttons and text fields. Connectivity features include Bluetooth, web browser, accelerometer, barcode scanner, location sensor, and activity starter; social features like Twitter, email, and messaging. The program is utilized to generate the text-to-speech program. The gadget, like an Android phone or PC, is connected to the device's Bluetooth module in that application via Bluetooth communication. Once we connect to the system, we receive serial data, which converts to text to speech.

RESULTS

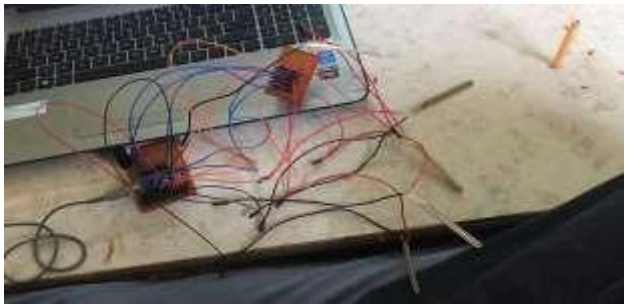

Figure 10: - Initial Setup

To a limited extent, the system indicated above can translate sign signals and recognize letters from A to Z and numerals from 0 to 9. The phone, which is an Android device that is still under development, receives the audio output, and the output is shown on an LCD screen. The hardware setup figure illustrates the basic components of the system, including the accelerometer, flex sensors, LCD, Bluetooth device HC-05, and Arduino Nano.

Figure 11: System Prototype

Figure 12(a): Final Prototype

Figure 12(b): - Final Prototype

The finished prototype is shown in Figures 12(a) and 12(b), while the initial prototype of the system is shown in Figure 11. The sensors were stitched onto net cloth during the glove's initial creation. The glove was failing to deliver the proper value that it should have. The output was erroneous because, as we were sewing the sensor onto the net, the cloth started to tear. The net gloves also had problems fitting. We stitched sensors, an Arduino nano board with an LCD display, and a Bluetooth module into the cotton glove instead of the net gloves to fix the problem.

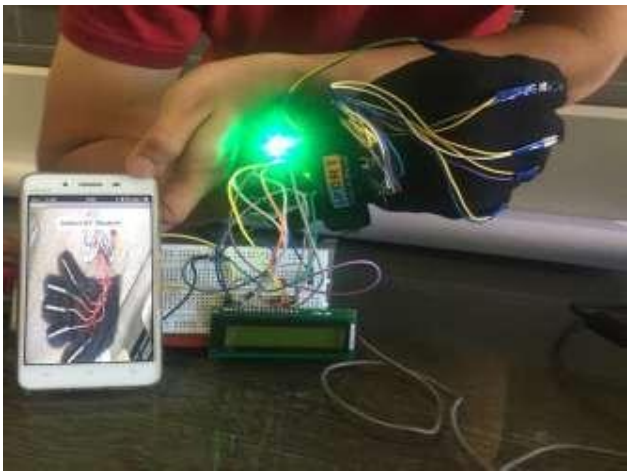

Figure 13: - System with android application

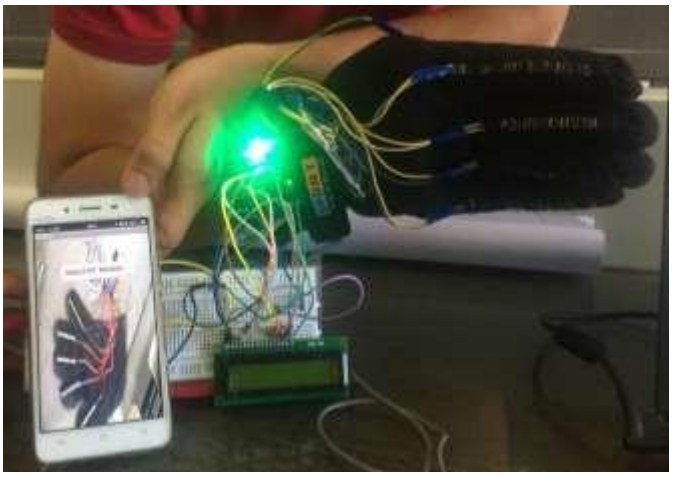

Figure 14: - System with android application

The diagram above shows the entire system—the gloves, LCD, and Android software on the phone included. The image shows how to connect the gloves and set up the Android phone to seem the way you want it to. The application displays a list of Bluetooth devices that are compatible after selecting the "Select BT module" block. Proceed to select the "HC-05" device and link the Android phone to the electrical circuit. It then outputs to the screen in red and with sounds. As seen in Figure 1, the alphabet "B" output is shown in Figure 14. The following motion designates letter B. The values of the thumb's sensor (flex) valve are less than 100, but the index, middle, ring, and pin key fingers have values of 255. When these conditions are fulfilled, speech output is generated and only the alphabet B is displayed on the LCD and on the Android phone via Bluetooth. Therefore, the letters "A, C, D, E, F, H, I, M, and W" will be the output if the process is successful.

FUTURE WORK

1.One way to increase the device's portability is to utilize a tiny Lippo battery, which can be recharged repeatedly.

2. The system's user interface might use some work.

3. The development of the other glove would enable the production of sentences and the execution of hand gestures.

CONCLUSION

The system fills in the communication gaps between dumb/deaf persons and normal people, acting as a bridge between the two groups. With little weight and power consumption, the gloves can be used independently and are portable. The system translates hand signals into text and then speaks. There is a mechanism in the text system that allows a person to read and comprehend what someone else is trying to say even if they are not able to hear the sound that is being made.

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