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ARDUINO BASED SIGN LANGUAGE TRANSLATOR USING GLOVE

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ABSTRACT: This paper discusses the formation of a device-based sign language translator. The simplest form of communication in the world is speech. Since most persons with speech impairments communicate using sign language, it becomes more difficult for them to interact with regular people. The communication gap between those with speech impairments and the general population is too great for them to cross when they interact with one another. There are two methods for recognizing gestures: image processing-based and sensor-based. The paper goal is to create a smart glove that can translate sign language, making it easier for those who are deaf or hard of hearing to communicate. In this paper, gloves must have sensors that can detect various sign language motions, such as touch, accelerometer, and flex. Fingers with flex sensors attached measure how much a finger bends in response to a motion. An accelerometer that measures the hand's location in the axes is put on the palm. Touch sensors are positioned in the spaces between the fingers to detect any contact. The Arduino UNO board receive the detected data from the sensor, processes, and then use a Bluetooth module to send the data to an Android phone. We will receive the data in text format. After then, Google Text-to-Speech converts this text data into speech.

INTRODUCTION: As handicapped persons do not have the conveniences that a normal person should have, it is exceedingly difficult for deaf and dumb people to communicate with the general public in the modern world. The same issue arises when two people who speak different languages cannot communicate with each other. As a result, they need a physical translator, which is not always convenient to arrange. This same issue can also arise when two normal people speak different languages and are unable to communicate with each other. Even though technology has advanced quickly in this digital era, sign language remains the primary means of communication for the deaf and silent. While connecting with those who are not familiar with sign language can still be problematic, use the sign language as a communication apparatus can be helpful within the community[1]. The best way for deaf and silent persons to communicate effectively through technology in several languages is through Sign Language Translator.

Given that sign language is a formal language used by the deaf to communicate, it is a system of hand gestures. Glove-based systems were employed in several initiatives to automatically comprehend the gesture languages spoken through the deaf people[2]. The system created for these projects varied in terms of things like the percentage of correctly classified signs, the sorts of signs (which may be static or dynamic), and the quantity of classifiable signs (anything from a few hundred to thousand). The most basic systems could only recognize manual alphabets, which are only a set of static hand and finger combinations that represent letters, or finger spelling. Using a Data Glove, Takashi, Kishino, Murakami, and Taguchi were able to recognize the Japanese letters[3-4]. Using an Accele Glove, Hernadez-Herbollar recognized the American alphabet.

Visual languages such as sign languages rely on hand, face, and body gestures to convey meaning. American Sign Language (ASL), Australian Sign Language (Auslan), and British Sign Language (BSL) are just a few of the more than 135 sign languages spoken around the world. Additionally, there are mixed versions of oral languages like Pidgin Signed English (PSE) and signed versions of oral languages like Signed Exact English (SEE). For those who are Deaf sign language is frequently the primary means of communication; nonetheless, sign languages are beneficial to everyone. For a great deal of the deaf and hard of hearing community, sign languages constitute an indispensable means of communication.

The Deaf community speaks sign languages, which are their native tongues and offer complete communication access. Individuals with sign language proficiency are frequently far better listeners. One has to maintain continuous eye contact with the person speaking when utilizing sign language[5]. When using sign language, as opposed to spoken language, one cannot turn away from the speaker and still listen. Having this practice may be very helpful for both sign language and spoken language. When communicating verbally, keeping eye contact demonstrates that one is really interested in the other person's words.

American Sign Languages (ASLs):

Although American Sign Language and English have the similar alphabet, American Sign Language is not a split of English. American Sign Language was formed independently and has its own linguistic structure in Fig 1. (In reality, its progenitor is Old French Sign Language.) In addition, the order in which signs are expressed is not the same as that of English words[6]. This is due to the fact that sign language is mostly visual and has its own unique grammar

Fig 1 : American Sign Languages

New Zealand Sign Language (NZSL):

The same sign language alphabet is used by New Zealand Sign Language, British Sign Language, and Sign Language (Auslan). These alphabets, which are seen in Fig. 2, employ two hands rather than one, in contrast to ASL[7].

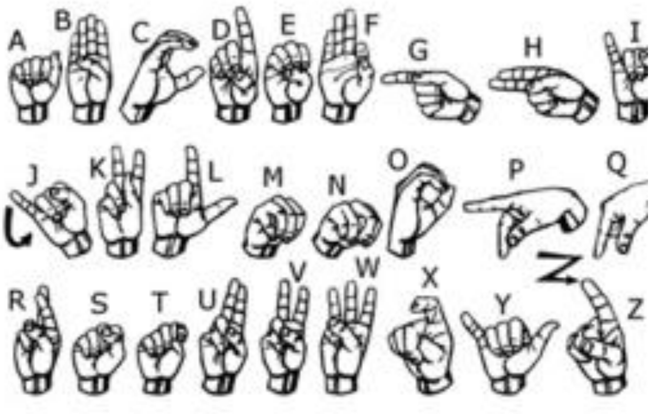


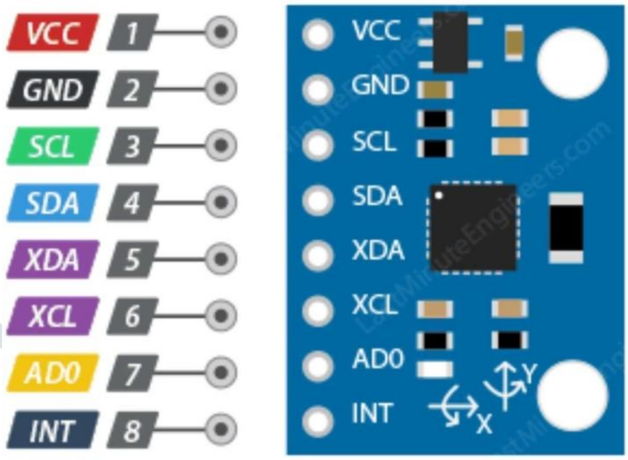
Fig 2: New Zealand Sign Language

HARDWARE EQUIPMENTS:

The hands' backs were equipped with accelerometers to detect if they were positioned horizontally or vertically, The code was written on an Arduino nano, and the glove and phone were connected using an HC-05 Bluetooth device.These components were used to construct a smart glove that could convert ASL individuals into both spoken and written individuals in a mobile phone application.

FLEX SENSORS:

A form of sensor that measures the amount of deflection or, alternately, bending that has happened is called a flex sensor, as seen in Figure 3. This sensor may be constructed using carbon and plastic. When the plastic strip containing the carbon surface is moved aside, the resistance of the sensor will change. For this reason, it is sometimes referred to as a bend sensor[8]. These sensors fall into two groups based on size: 2.2-inch flex sensors and 4.5-inch flex sensors. The size and resistance of these sensors varied, save from the principle of operation. In this work, 2.2-inch flex sensors were used. This type of sensor may be used for intensity control, security systems, music interface, and any other location where the user wishes to change the resistance while bending. Because the flex sensor just has two terminals and no polarized terminals, like capacitors or diodes, it has no positive or negative terminals. Any type of interface can be used to acquire the 3.3V to 5V DC required for this sensor to activate. This sensor is used anyplace it's required to calculate the amount that an instrument or device has flexed, bent, or altered its angle[9]. Therefore, we may acquire the flex angle within electrical parameter resistances by adding the sensor to the device.



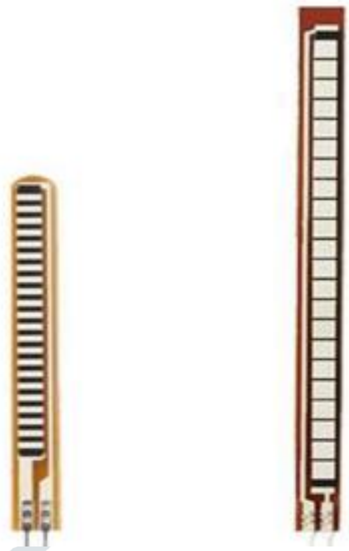


FIG 3:2.2" Flex sensor and 4.5" Flex sensor

ACCELOMETER:

Accelerometers are frequently used in low-cost, low-power motion and tilt detection applications, such as picture stabilization, gaming systems, sports and fitness equipment, mobile devices, and disk drive security in Fig.4.The micro-machined Micro-Electro-Mechanical System accelerometer is built on a silicon wafer[10]. This structure is supported by polysilicon springs. The structure may deflect when there is an acceleration in the axes. As a function of deflection, the capacitance between the fixed plates and the plates attached to the hanging structure changes. This change in capacitance is proportional to the acceleration along that axis. The sensor processes the change in capacitance and converts it to an analog output signal. It can measure both static and dynamic acceleration caused by motion, shock, or vibration[11].

.VCC: delivers power to the module. Attach it to the 5V output of your Arduino.

GND: should be connected to the ground of Arduino

FIG 4: accelometer

HARDWARE DESIGN:

The accelerometer and flex sensors provide data to the Arduino nano, a hardware circuit seen in Figure 6. The gesture recognition code that is detailed in the paper's latter portion is then used by the Arduino Nano to translate any gestures based on this data. When the Arduino has analyzed the input signals from the sensors, it sends the commands to the output component. The board has sixteen analog input pins that can handle a total of five analog inputs from flex sensors and an accelerometer. After the translation is completed, the output is processed and simultaneously presented on a mobile device and spoken out by a speaker.

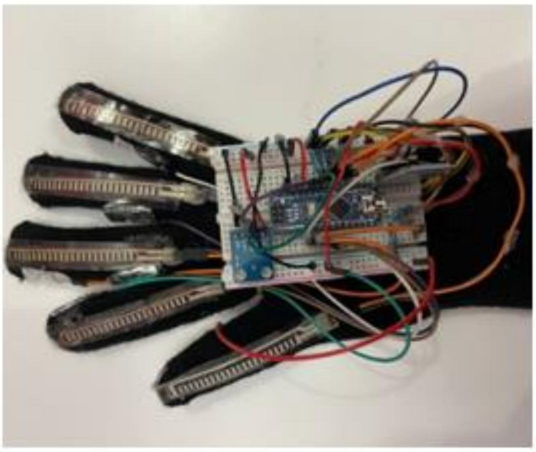


FIG 5:Hardware design

RESULTS AND DISCUSSIONS

The results of some of the ASL letters are listed in the Figure 6 to Figure 9, Given that the findings contain sounds, a film including every ASL letter is produced.

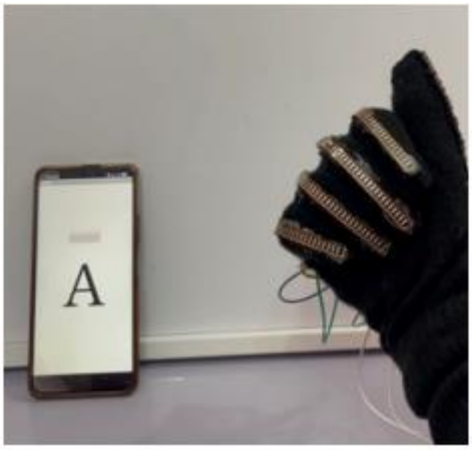


FIG 6:The letter A

FIG 7: The letter C and F

FIG 8: The letter H

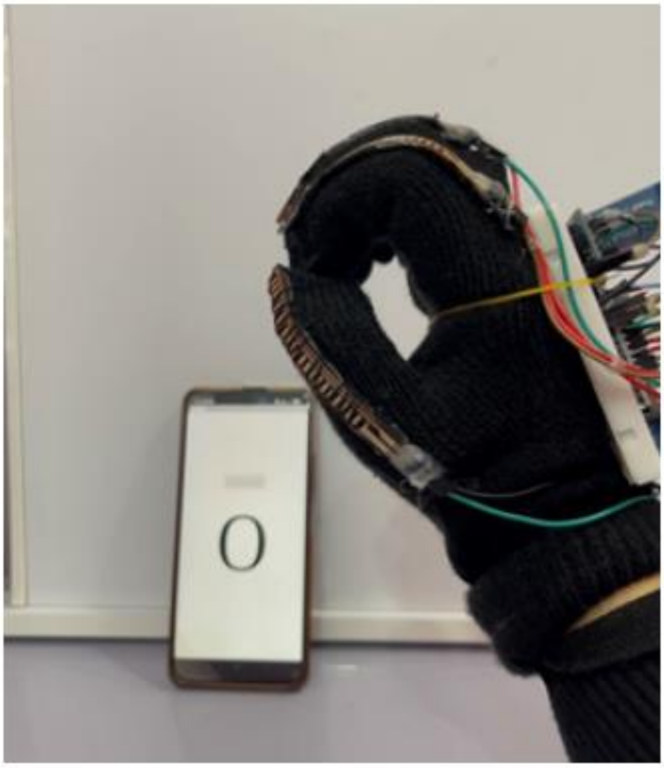


FIG 9: The letter O

A problem with it is that it is difficult to discern between the letters U and V. At this moment, wires are used to connect the device and microcontroller. Preliminary testing of the gadget indicates that the cables may impede hand motions.

Therefore, in the future, a wireless link between the device and microcontroller utilizing "E-TEXTILE" may be employed to develop a solution to this problem. Our primary objective, given that this was only a prototype, was to develop a design that facilitates improved communication among people with disabilities. For this prototype, we just displayed some alphabetic characters; we didn't decode any words. This is a weakness in our article that can be addressed in other studies.

CONCLUSION:

In order to help blind and deaf-blind individuals communicate with non-blind individuals who are unfamiliar with braille, we created a Smart-Glove. The Smart-Glove can establish a connection with an Android smartphone and enable messaging. On the other hand, text messages may be sent and received between the Android application and the Smart-Glove, and the Smart-Glove can transmit and receive braille messages. The Smart-Glove is low-cost, lightweight, simple to use, and risk-free. If deaf-blind persons are taught braille, we think the initiative would be highly beneficial and successful in helping them communicate with their loved ones and others.

Code availability

Code is available, and can be shared upon request.

Conflict of Interests: The author declare no conflict of interest.

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