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# SMART GLOVES TO UNDERSTAND SIGN LANGUAGE

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**Abstract:** ***This paper examines the possibility of understanding and producing text output using smart gloves. This project uses sensors that calculates the hand moment and predicts the accurate text output. The hand gloves learn and understand the hand moments based on the American Sign Language standards.***

## Introduction:

Sign Language is the language used by deaf and mute people. Unlike other languages, sign language consists of moments of parts of body. For example, hand gestures, head moments. Facial expression also counts toward the gesture. The number of sign languages worldwide is unknown. It is said that around 150 sign languages exist around the world. The most popular sign language is ASL (American Sign Language), which is widely used in the USA and Canada. The ASL is complete natural language that has the same properties as normal spoken language with grammar that is different from English.

## Smart Gloves:

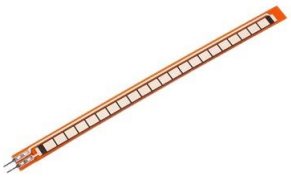
The smart gloves are ordinary gloves with sensors embedded on it. These sensors are mainly flex sensors and Gyroscope. These sensors are controlled by a microcontroller that takes input from sensors, processes the data and produces the output in the form of text. The pair of gloves consists of 10 flex sensors and 2 Gyroscope. The following explains how these sensors play a vital role in sign language understanding.

## Hardware:

## Flex Sensors:

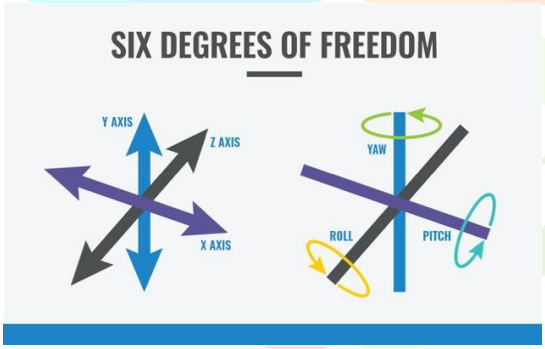
The flex sensors have variable resistance, that value of the resistance lies from 0 to 4095. 0 means fully stretched, 4095 is the maximum amount of deflection. The designing of this sensor can be done by using materials like plastic and carbon. The carbon surface is arranged on a plastic strip as this strip is turned aside then the sensor's resistance changes.

These sensors are places on every single finger of the gloves. When the use moves the finger, the microcontroller notes the value and passes it to the algorithm. These sensors are most important because that finger moments are used as the primary moment in the gesture language.



## Gyroscope:

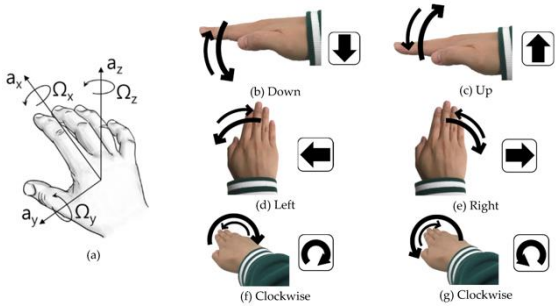
In Greek Gyro means Circle, Gyroscope is a device that is used to measure or maintain orientation and angular velocity. It consists of spinning wheel of disk attached to a frame, with a spinning axis of rotation. It is allowed to orient by itself. measure angular velocity in simple words this sensor is used to measure change in rotational angle per unit.




Based on this principle the Gyro sensor also knows as angular rate sensor, used to
The Gyro scope helps in determining the moment on hand gesture, this sensor is used to measure angular velocity, hence such moments like Roll, Pitch and Yaw. Along with flex sensors are used to detect sign language. The values of Gyro range from ±125, ±245, ±500, ±1000, ±2000 degree per second (DPS).

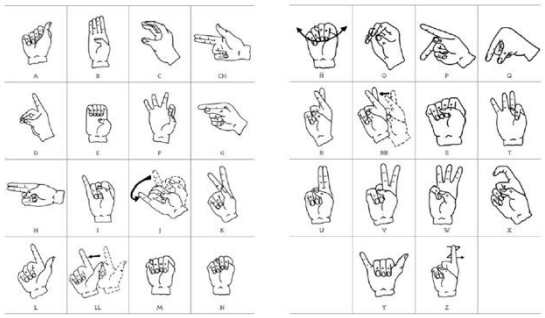
## Microcontroller:

The brain of this project is Raspberry pi Zero, which is portable and easy to use. To make this project simple and easy, no machine learning algorithm is used. However, according ASL there are roughly around 660 hand gesture pattern including letters, numbers and expressions. These patterns are compared with smart glove gesture input and then output is generated.



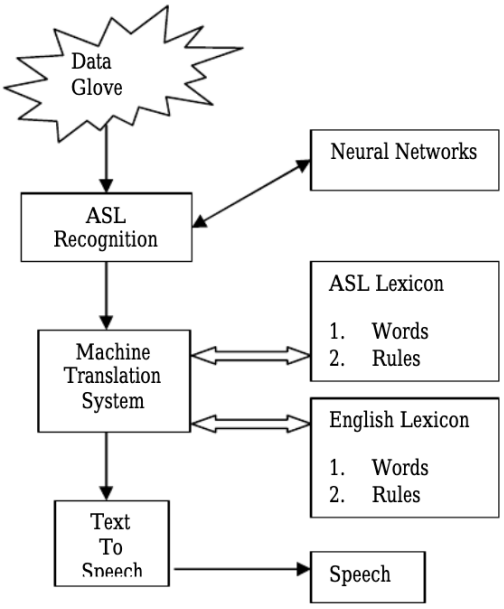

## Understanding Sign:

To initialize, first the gloves have to stretched are the Gyro needs to be calculated calibrated. To do this user need to rotate the wrist in all 3 axes (X, Y, Z directions). Now the gloves are ready to show output. To show number ‘1’ the one hand has to be closed and on the other hand, index finger should be stretched with remaining fingers needs to be closed. And similarly, index and middle fingers are to be stretched for number ‘2’ and so on.



## Future Development:

By using Neural Networks, the glove can learn and improves its responses. By implementing machine learning, the output can be refined and will be able to produce fast and more accurate results. By using google text to speech, the produced text output can be converted into speech.




## Existing Problem:

The only problem that we face in this project is, the two letters 'j & z' are not recognized by the glove. This is because it is complex to recognize and compare with the sample data. Due to this, some words take time to show output.

## Proposed Solution:

In order to avoid this problem, new gesture has to be created, using a sensor placed on the shoulder or elbow.

## Result:

The accuracy rate of the software was found to be 88%. This figure is lower due to the fact that training was done on the samples of people who did not know sign language and were given a handout to perform the signs by reading from it. So, there was great deal of variation in the samples. Some samples even gave completely wrong readings of the sensors. Testing was also done on the same kind of people.

## Conclusion:

This prototype is meant to check the feasibility to of sign language recognition using smart gloves. This prototype is not complete 100% solution, as it cannot convert real time sign language into text. But it can partially help challenged people with communication problem. In future more sensors and algorithms can be used to make this prototype into real time language converter.

## References:

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