SMART GLOVES FOR HEARING AND SPEECH IMPAIRED

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CERTIFICATE

This is to certify that this is a bonafide work of the project entitled **SMART GLOVES FOR HEARING AND SPEECH IMPAIRED** carried out by the following students of final year in Electronic and Telecommunication Engineering.

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This project is carried out for the partial fulfilment of requirements for the degree of Bachelor of Engineering (B.E.) in Electronics and Telecommunication from University of Mumbai, for academic year 2019-2020.

Internal Guide   Head of Department   Principal

PROJECT REPORT APPROVAL

This project report entitled **SMART GLOVES FOR HEARING AND SPEECH IMPAIRED** by following students is approved for the degree of **Bachelor of Engineering** in **Electronics and Telecommunication Engineering**.

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DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date:

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ABSTRACT

People have the ability to interact with the surroundings, hear and speak. But not all are fortunate enough. Deaf and dumb is that population that cannot hear or speak. These people usually find it difficult to interact with other people. They use hand gestures for this purpose or we can call it the sign language. Even after using this language people find it difficult to understand. This causes difficulties for the differently abled people for interaction even in educational and professional fields. Hence to overcome these problems we have designed a project called SMART GLOVE FOR HEARING AND SPEECH IMPAIRED. This will help the deaf and mute people to remove the communication barrier. Smart glove is a wearable technology. It is a device which consists of specific sensors with great temperature stability. All the sensors are pasted on a glove which measures the different analog parameters associated with the movement and orientation of fingers and hands orientation if any gesture is done. These sensors read the particular analog values and according to these values coding is done to recognize the gestures. The aim of this project is to develop a communication system and to convert or translate these gestures into sound and speech.

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List of Abbreviations

- **ARQ** Automatic Repeat Request
- **MSA** Mathematical Sound Architecture
- **HMM** Hidden Markov Model
- **ANN** Artificial Neural Network
- **EMG** Electromyography Sensor
- **MPU** Microprocessing Unit
- **SVM** Support Vector Machine
- **UART** Universal Asynchronous Receiver/Transmitter
- **ICSP** In Circuit Serial Programming
- **MEMS** Micro Electro Mechanical System
- **I2C** Inter Integrated Circuit

Chapter 1

INTRODUCTION TO SMART GLOVES

1.1 Introduction

People have the ability to interact with the surroundings, hear and speak. But not all are fortunate enough. Deaf and dumb is that population that cannot hear or speak. By and large we meet numerous individuals those are not ready to talk serenely with us like hard of hearing and mute individuals. They are conveying information by methods for communication through gesture or signs. Signs are utilized to impart words and sentences to crowd. Even after using this language people find it difficult to understand. This causes difficulties for the differently abled people for interaction even in various fields. Hence to overcome these problems we have designed a project called Smart Glove. It is a device which consists of specific sensors with great temperature stability.
All the sensors are pasted on a glove which measures the different analog parameters associated with the movement and orientation of fingers and hands orientation if any gesture is done. These sensors read the actual analog values and according to these values coding is done to recognize the gestures. They make use of signs or gestures to communicate as they find it easy to move their hands or fingers to describe what they exactly want to say. But it is not necessary that everyone understands these signs. A communication through gesture as a rule gives sign to entire words. Those words that do not have a relative gesture, a particular sign can be assigned to them. This glove will help the differently abled people to make gestures and communicate with the other people without any help or relying on someone. Based on the gestures made by an individual, we will get an output in the form of visual display or sound.

1.2 Need of Project

Correspondence between a hard of hearing and ordinary individual is as same as that of two distinct individuals from various nations who are utilizing two unique dialects for correspondence which prompts an issue in correspondence. Gesture based communication is the main specialized apparatus utilized by hard of hearing individuals to speak with one another. Be that as it may, typical individuals do not comprehend gesture based communication and this makes a huge correspondence boundary between hard of hearing individuals and ordinary individuals. Moreover, the communication via gestures is additionally difficult to learn because of its normal contrasts in sentence, structure and syntax. In this manner, there is a need to build up a framework which can help in making an interpretation of the gesture based communication into content and voice so as to guarantee that successful correspondence can undoubtedly occur in the network.

1.3 Literature Survey

To convert sign language or gestures into speech, Enable Talk was proposed. In 2012 the same project was presented at the Microsoft Imagine Cup where it stood first. Sidney Fels and Geoffrey Hinton, Department of Computer Science of University of Toronto, invented Glove Talk II. It was based on signal to format model and neural networks was used for this purpose[1]. The current version of Glove Talk II consists of several inputs. It segregates the vowels and consonants using a gating network and it checks the output weights of the vowel and consonant system It segregates the vowels and consonants using a gating network and it checks the output weights of the vowel and consonant system. With the help of the inputs given by the user the gating as well as the consonant network are trained. The vowel network shows a user-defined relation between the hand-gesture and vowel sound and it does not need any training inputs given by the user.
Tushar Chouhan designed an interactive glove consisting of wires, associated with software like MATLAB or some other software like OCTAVE, with maximum degree of accuracy[2]. The glove will take a call on the orientation of the gestures or signs with the assist of bends or curves of the flex sensor, hall effect sensor and an accelerometer to find speed. The data is then sent to a PC utilizing Automatic Repeat Request (ARQ) which helps with dealing with the blunders that have occurred. The structure is built or constructed for the people having hearing and speech issues to help them convert into the sign languages speech or textual messages.

Speak jet was an audio equalizer which was utilised to convert the text data into voice audible data It uses the Mathematical Sound Architecture (MSA) technique to deal with a five channel sound equalizer to make a discourse signal [3]. It has seventy two discourse segments, forty three sound outcomes and twelve DTMF prod tones. With the use of MSA part and furthermore pitch, rate, measure of twist, and sound volumetric structure the client can create different sound outcomes. They worked on to creating an electronic speaking gesture glove, designed to help an ease in the communication through equalised speech for the advantage of the people who cannot hear and speak. Usually, a person who is unable to speak communicates through signs or gestures which is not interpreted by the people who are not differently abled. The actual system was implemented to resolve this difficulty. Gestures or signs by the person given to this glove will be changed or converted into synthesized speech to inform the people so that they can understand the message, for example in an important communication with a doctor. The glove is equipped with various flex sensors from inside which are made up of "resistance elements" which are sensitive to bends or curves. For every unique sign, the flex sensor will construct a change proportional to the resistance of different components. The executing of this content will impart a specific measure of signals to Peripheral Interface Microcontroller and speak jet integrated circuit which is as of now customized to give the necessary sentence or lines.
An image based system was proposed to recognize Arabic sign language by M. Mohandes. By using the Gaussian skin model the system detects the user's face. The origin is taken as the centroid of the detected face for every frame and the hand movements are tracked by using region growing technique. The classification of the signs is performed by using the HMM i.e the Hidden Markov Model [10].
The machine vision system was used to detect nine phonemes in English by M.P. Paulraj, i.e a simple sign language recognition system. Artificial Neural Network and skin color segmentation was used. Preprocessing, feature extraction and gesture classification were the three stages present in the system. The preprocessing stage consisted of skin color detection and region segmentation. Based on the RGB values in the image frame, skin color was detected. Moment invariant features were extracted in the feature extraction stage.
The gesture classification stage then uses these features as its input to ANN to recognize the sign. It is reported that the average recognition rate for this system is 92.85Wang presented a sign language recognition system that uses tensor subspace analysis to model a multi-view hand gesture. The hand recognition process is achieved through color segmentation. Input image that is in RGB color space is converted to YCbCr color space to ease the process of detecting the skin that employs the Back Propagation (BP) network model. The sign language recognition is modeled and recognized using tensor. Then, the matching process is carried out

to identify the input hand gesture [12].
Glove based systems on the other hand employs sensors attached to the glove captures the movement of the hand and finger and also the rotation. Many efforts have been made to interpret hand gestures, particularly the signals which are changing over time Hidden Markov Model (HMM) is employed as an effective tool in most of the works. A system with two data gloves and three position trackers as input devices and a fuzzy decision tree as a classifier is used to recognize the Chinese Sign Language gestures [13]. With 5113 signs vocabulary, it achieves 91.6accuracy. The combined accelerometer and the surface electromyographic sensor provides an alternative method of gesture sensing unlike the above two methods mentioned previously.
The Kinematic information of the hand and the arm are provided by the accelerometer and also it is capable of distinguishing the hand orientations or movements with different trajectories [14]. EMG Sensor measures the electrical activity provided by the skeletal muscles and the signal contain rich information for the coactivation and coordination of multiple muscles associated with different sign gestures. Recent works on ACC and sEMG have demonstrated the improved recognition performances. For instance, it is shown that the sEMG combined with ACC can achieve accuracy in the range of 5–10functionality of both sensors is examined for the recognition of seven isolated words in German sign language. The intrinsic mode entropy is successfully applied on ACC and sEMG data acquired from the dominant hand to recognize 60 isolated signs in Greek sign language [15]. Recently, a wearable system using body-worn ACC and sEMG sensors is designed to remotely monitor functional activity in stroke.

1.4 Objectives

The main objective of the project is to help the Deaf and Mute to put forth their views and interact with the rest of the world.
The important objectives are:

1. To design and develop a system which lowers the communication gap between speech-hearing impaired and normal world.

2. To help not only the Deaf and Mute but also others who are deprived of this privilege or aren't in the state of doing the same. For example, any patient who cannot ask for things easily can also make use of this product.

1.5 Methodology

1.5.1 Hardware Assembly

To record the changes in the values of the output caused by the accelerometer and gyroscope of MPU6050 and the bend of the sensors, a flex sensor was placed on each finger and they were interfaced with Arduino mega 2560. Arduino Mega has been programmed so that it sent 11 informations or datas from all the sensor which are 5 flex sensor information, 3 accelerometer information and 3 gyroscope data taken at duration of 500ms to its serial port. Along these lines, in 1 second duration there were 22 data at the serial port. Arduino was connected to the serial port of the computer and by the use of python programming language the data at the serial port was gathered.

1.5.2 Dataset Preparation

1. Dataset Collection
   We created the datsets for training the machine using the data which was collected at the serial port of arudino and then we stored those values in csv file format. This data consists of eleven values i.e five from the flex sensors and three each from the accelerometer and gyroscope respectively. The data which was collected was for those words are used very often.

2. Data Pre-Processing The information which was collected was then segregated with their respective word as the final or expected value, and the final data which was collected was randomized so as to reduce the change and to ensure that the model stays general and overfits less.

1.5.3 Machine Learning

Random forest Algorithm which is based in the concept of ensemble learning is used for classification or regression. It creates many decision trees for the training of the datasets and gives a precise output based on these decisions. Accuracy is very good. Classification is nothing but the mode of the individual trees whereas regression is the mean. Based on the output of these decision trees, the output that gets the maximum number of votes is selected. Random forest is considered to be very accurate and a powerful method.

1.5.4 Random Forest Algorithm

- From the Original Dataset we randomly select samples and create a Bootstrap Dataset. In this, repeating a sample or ignoring a sample is allowed.
- Using these samples we plot the decision trees in which a subset of the nodes is considered.
- Based on the outputs of the various decision trees, the output with the maximum vote is selected as the final output.

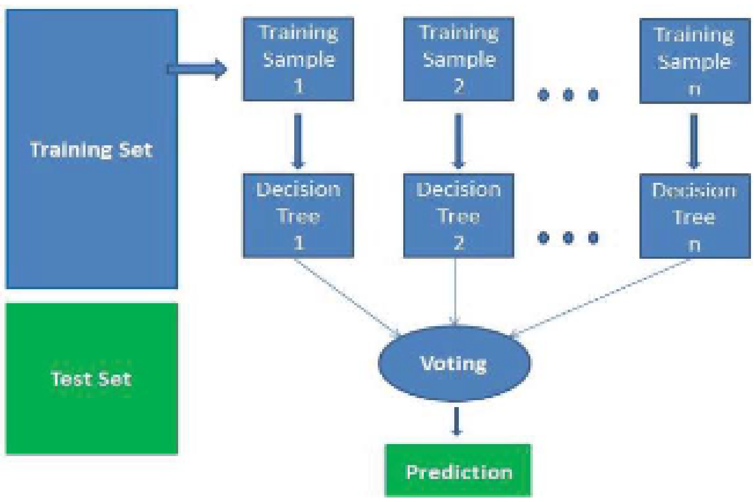

Figure 1.1: Random Forest

Chapter 2

SYSTEM DESIGN

2.1 System Architecture

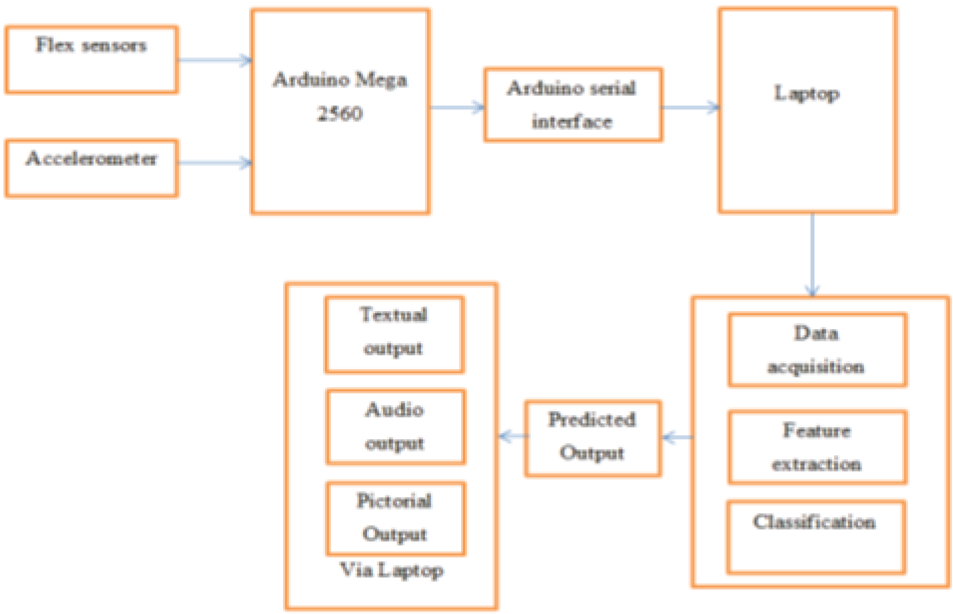

Figure 2.1: Block Diagram of The System

When hand motion is made by the handler, user gives eleven inputs from the glove controller to the system which consists of three axes accelerometer signal, three-axes gyroscope signal and five flex sensor signals. These eleven values that are

taken from the user acts as a key in identifying a specific signal. These features of the gestures is then passed through random forest classifier, and then the gestures are classified according to the features, and the output is predicted.
When we do a specific gesture using the glove, the data from the sensors and MPU were collected. The processing was done using Arduino. This was used to obtain proper output. After getting the data it was sent to the serial port. Using python we collected and stored that temporary data. Using feature extraction the data was collected. The appropriate output was then predicted for the given gesture. This output is reflected on the computer screen or the speaker.

2.2 Feature Extraction

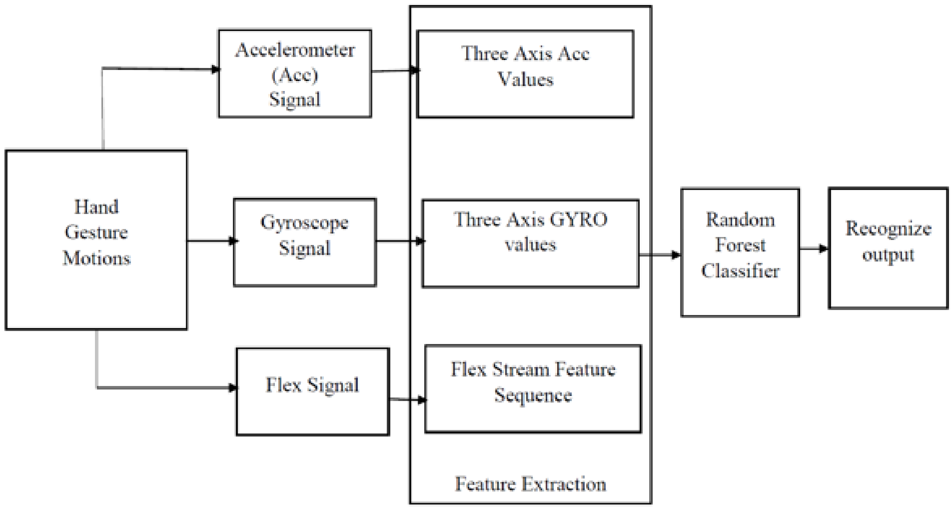

Figure 2.2: Process Of Feature Extraction Values

2.3 Process Of Dataset Preparation using Arduino

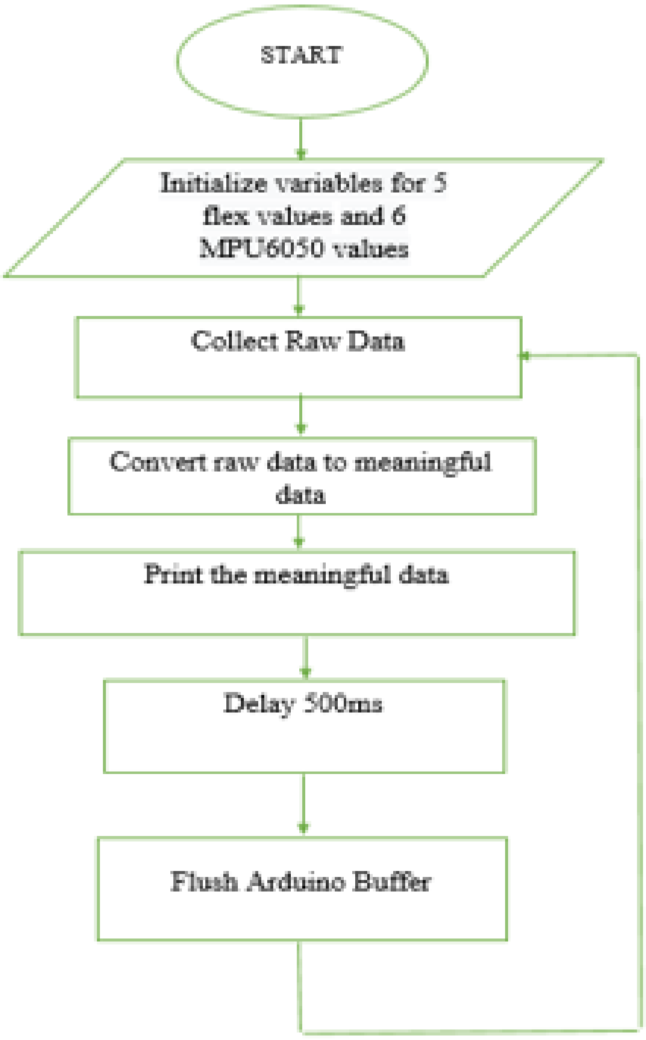

Figure 2.3: Flowchart for Dataset preparation using Arduino

2.4 Process Of Dataset Preparation using Python

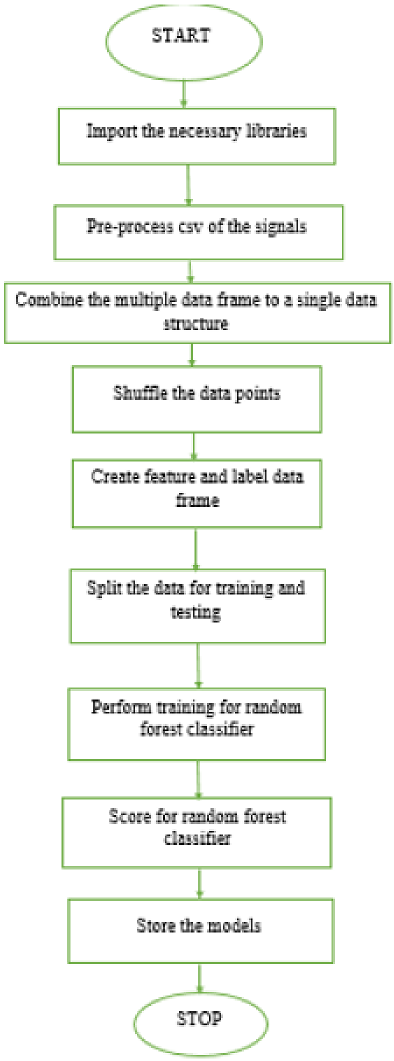

Figure 2.4: Flowchart for Dataset preparation using Python

2.5 Process Of Real Time Application

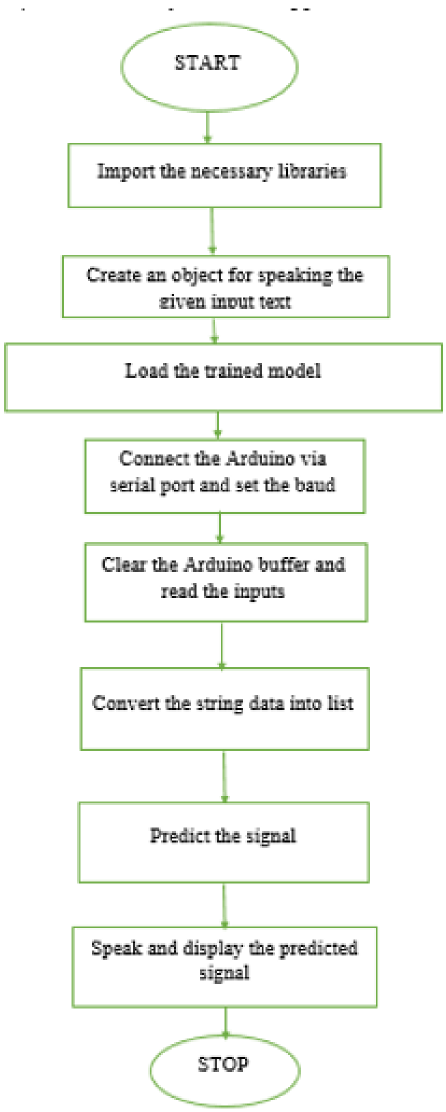

Figure 2.5: Flowchart for Real Time Application

Chapter 3

Software

3.1 Arduino IDE

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows. Simple, clear programming environment. The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers.

3.2 Machine Learning

Machine learning is a data analytical technique that trains computers or machines to derive results from experience which resembles to the natural ability of humans and animals. Machine learning algorithms can use computational methods to “learn” information straight from data without depending on a fixed equation as a model. The algorithms adaptively enhance their throughput as the number of samples available for learning increases. It is a subset of artificial intelligence in the field of computer science that often uses statistical techniques to give computers the ability to ”learn” (i.e., progressively improve performance on a specific task) with data, without being explicitly programmed. Machine learning is closely related to (and often overlaps with) computational statistics, which also focuses on prediction-making through the use of computers. It has strong ties to mathematical optimization, which delivers methods, theory and application domains to the field. Machine learning is sometimes conflated with data mining, where the latter subfield focuses more on exploratory data analysis and is known as unsupervised learning Machine learning can also be unsupervised and be used to learn and establish baseline behavioral profiles for various entities and then used to find meaningful anomalies.

Machine learning uses two sorts of strategies: supervised learning, which prepares a model on known data and output data that helps in predicting future outputs, and unsupervised learning, which finds obscure patterns or inherent framework in input data.

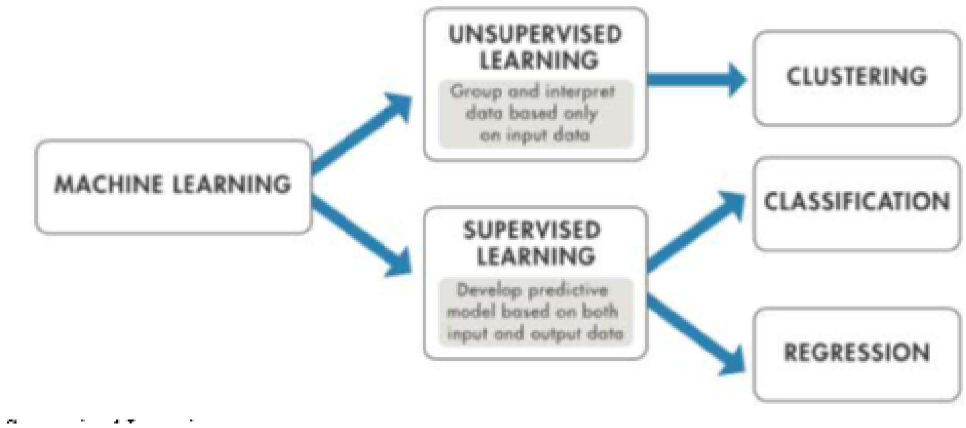

Figure 3.1: Machine Learning Strategies

3.2.1 Supervised Learning

Supervised machine learning constructs a model that makes predictions dependent on evidence in the presence of ambiguity. A supervised learning algorithm uses a known set of input data and known reaction to the data i.e. output data and teaches a model to generate reasonable predictions for the reaction to new data. Supervised learning uses classification and regression techniques to develop predictive models.

Classification techniques predict distinct responses—for example, if an email is legitimate or spam, or whether a tumor is cancerous or benign. Classification models divide input data into categories. Typical applications include speech recognition, medical imaging and credit scoring. Use classification if your data can be tagged, categorized, or separated into specific groups or classes. For example, applications for handwriting recognition use classification to recognize letters and numbers. In image processing and computer vision, unsupervised pattern recognition techniques are used for object detection and image segmentation.
Common algorithms for performing classification include support vector machine (SVM), boosted and bagged decision trees, k-nearest neighbor, Naïve Bayes, discriminant analysis, logistic regression, Random Forest Classification and neural networks.

Regression techniques predict continuous responses—for example, shift in temperature or variation in power supply. Typical applications include algorithmic trading and electricity load forecasting. Regression techniques if you are working with a data range or if the nature of your response is a real number, such as temperature or the time until failure for a piece of equipment. Common regression algorithms include linear model, nonlinear model, regularization, stepwise regression, boosted and bagged decision trees, neural networks, and adaptive neuro-fuzzy learning

3.2.2 Unsupervised Learning

Unsupervised learning finds hidden patterns or intrinsic structures in data. It is used to derive interpretations from data sets consisting of input data without labeled responses.
Clustering is the most common unsupervised learning technique. It is used for exploratory data analysis to find obscure patterns or groupings in data.
Applications for cluster analysis include gene sequence analysis, market research, and object recognition. For example, if a cell phone company wants optimize the locations where they build cell phone towers, they can use machine learning to estimate the number of clusters of people relying on their towers. A phone can only talk to one tower at a time, so the team uses clustering algorithms to design the best placement of cell towers to optimize signal reception for groups, or clusters, of their customers.

Common algorithms for performing clustering include k-means and k-medoids, hierarchical clustering, Gaussian mixture models, hidden Markov models, self-organizing maps, fuzzy c-means clustering, and subtractive clustering.

3.3 Random Forest Algorithm

Random forest Algorithm which is based in the concept of ensemble learning is used for classification or regression. It creates many decision trees for the training of the datasets and gives a precise output based on these decisions. Accuracy is very good. Classification is nothing but the mode of the individual trees whereas regression is the mean. Based on the output of these decision trees, the output that gets the maximum number of votes is selected. Random forest is considered to be very accurate and a powerful method.

Algorithm for Random Forest Classifier:

- From the Original Dataset we randomly select samples and create a Bootstrap Dataset. In this, repeating a sample or ignoring a sample is allowed.
- Using these samples we plot the decision trees in which a subset of the nodes is considered.
- Based on the outputs of the various decision trees, the output with the maximum vote is selected as the final output.

Chapter 4

Hardware

4.1 Arduino Mega 2560

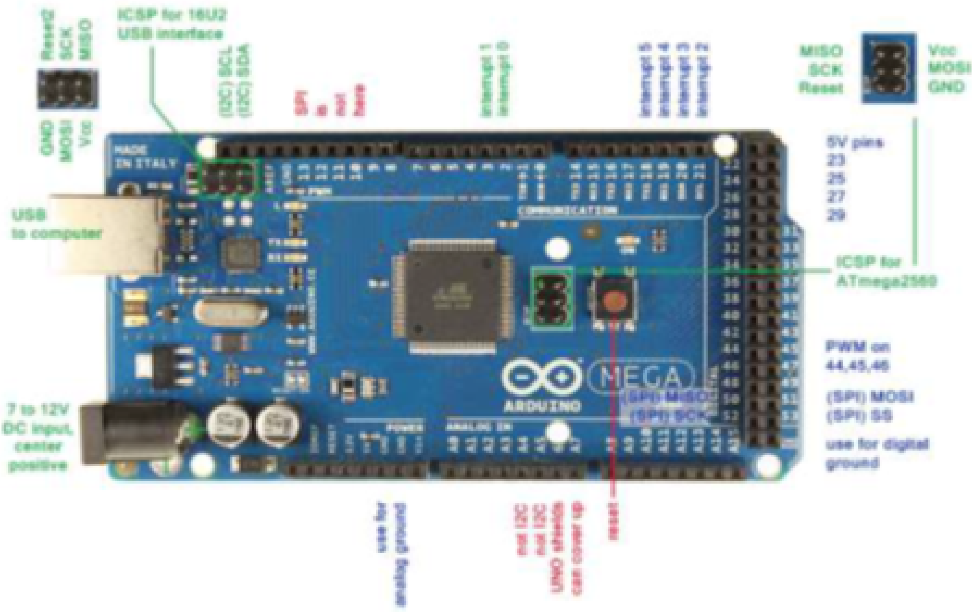

Figure 4.1: Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board dependent on the ATmega2560. There are 54 digital input/output pins. Amongst them, 15 pins can be occupied as PWM outputs and 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button are present in Arduino Mega 2560. It contains everything expected to help the microcontroller. To start working with it we have to just associate it to a CPU with a USB link or control it with an AC-to-DC connector or a battery. External supply of 6 to 20 volts is needed for the proper functioning of the board. As it is voltage dependent thee prescribed range is 7 to 12 volts. When its connected to a 5 volt pin it becomes unstable as the power supply is less than 5 volts. If the voltage is more than 12 volts the voltage controller is more likely to be overheated and this may harm the board.

4.2 Flex Sensors

Flex sensors are devices which are influenced by bending of the sensor. The resistance is directly proportional to amount of bending of sensor. The more the flex sensor is twisted the more is the resistance value. The dimension of flex sensor varies between 1 inch to 5 inch. Although they are available in different sizes but the basic function or operation remains the same. They can likewise be made unidirectional or bi-directional. The flex sensors are made with a similar guideline as strain gauges.

The carbon resistive elements within a thin flexible substrate are present inside the flex sensor which when bent produces a resistance output relative to the bend. The voltage divider form is the working principle of flex sensor. Sensors like these were utilized in the Nintendo Power Glove. Flex sensors operates on low voltages Flex sensors are usually available in two sizes. One is 2.2 inch and another is 4.5 inch.

At the point when the flex sensors are left flat, these sensors will resemble a 30k ohm resistor. As they bend, the resistance between the two terminals will increment to 70k ohm at a 90 edge. By consolidating the flex sensor with a static resistor to make a voltage divider, you can deliver a variable voltage that can be persued by a microcontroller's analog to digital converter. One side of the sensor is printed with a polymer ink that has conductive particles implanted in it. At the point when the sensor is straight, the particles give the ink an obstruction of about 30k Ohms. At the point when the sensor is twisted away from the ink, the conductive particles move further separated, expanding this obstruction. At the point when the sensor fixes once more, the opposition comes back to the original form. By estimating the obstruction, you can decide how much the sensor is being bent.

Figure 4.2: Flex Sensor

4.3 MPU-6050

The MPU-6050 is the only 6-axis Motion Tracking device that is designed such that it consumes less power, manufacturing cost is less and meets the performance requirements of smart devices and wearable sensors. A 3-axis MEMS gyroscope and a 3-axis MEMS accelerometer is inbuilt in MPU6050. The MPU6050, also called the 6 DOF (degrees of freedom) or a six-axis Inertial Measurement Unit sensor, will give six values as output, three of which are that from the accelerometer and the other three are from the gyroscope. The MPU6050 sensor is based on the technology known as MEMS (Micro Electro Mechanical Systems).

This chip uses I2C (inter-integrated circuit) protocol for communication. The IMU sensor that is attached to the object senses its location in the three-dimensional space. These angles are usually measured in angles convenience. All in all, it is the combination of 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor inside a small chip. It also has an additional feature of on-board temperature sensor. As discussed, it has I2C bus interface which helps in the communication from the sensor to different microcontrollers. It also has an Auxiliary I2C bus for communicating with other sensor devices like Magnetron, Pressure Sensor etc. When the 3 axis Magnetron sensor is connected to the MPU6050 through the auxiliary I2C bus, it can result to provide complete 9-axis Motion Fusion Output.

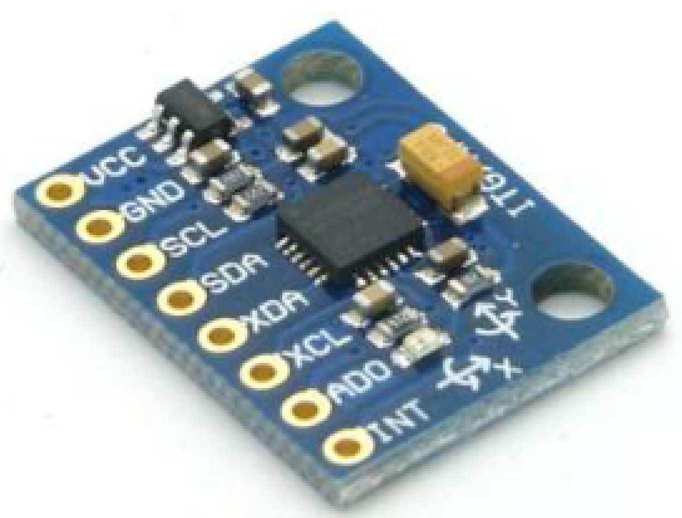

Figure 4.3: MPU-6050

4.4 Accelerometer

The 3 axis Accelerometer that exists within the MPU6050 sensor works on the technology called Micro Electro Mechanical (MEMs). Its main role is to measure the angle of the object's positioning with the three dimensional space or the X, Y and Z axis.

An accelerometer is an electromagnetic device. It measures the acceleration forces. These may be static forces like the constant force of gravity, or they could be dynamic forces which is caused by the movement or the vibration of the device. How it works basically is that by measuring the static gravity on the device we can find out at what angle the object is with respect to the Earth and by sensing the measure of the dynamic gravity we can assess the motion of the object.

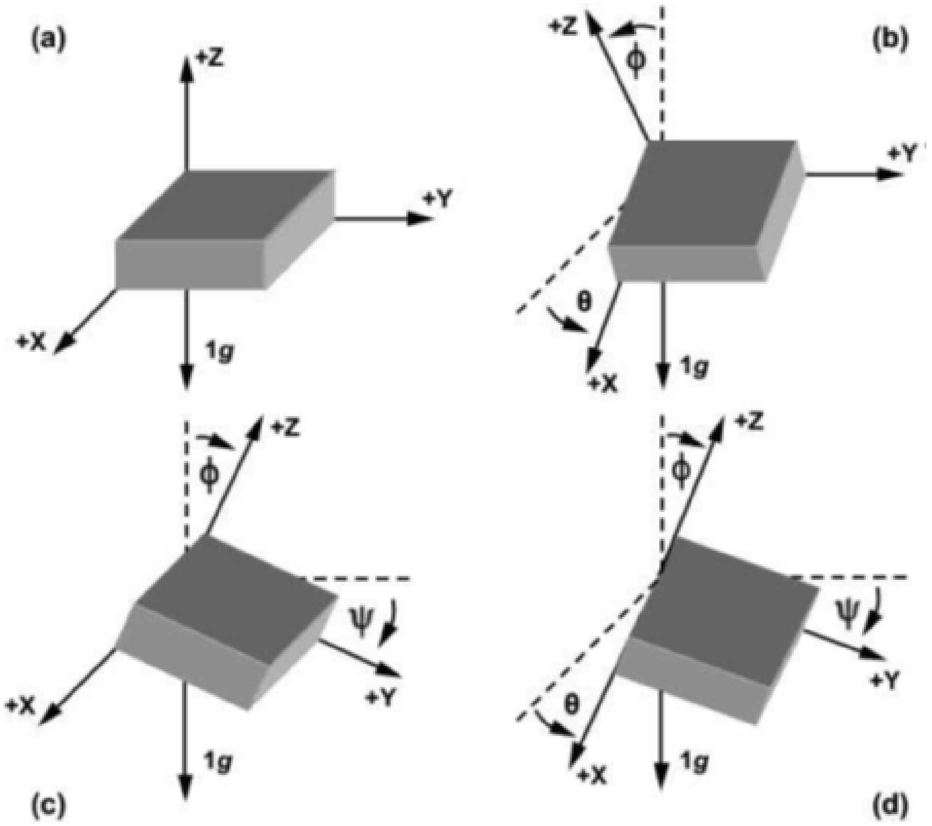

Figure 4.4: Accelerometer

There are many in ways in which these accelerometer works, one of them is with the help of piezoelectric effect, in this there is a crystal inside which gets compressed with the acceleration forces and this produces voltage. Another way to measure it is by sensing the difference in capacitances. When two microstructures are placed next to each other they develop certain capacitance between them. If any kind of force that is acceleration in case moves one of the plate or both the plates for that matter, they lead to change in their capacitance. By means of adding some electric network and converting this capacitance change to voltage, we will get our accelerometer. 16-bit ADC device is used to get the output amplitude which is proportional to the acceleration and is in digitized format. It measured in terms of g unit (gravity force). For example, when the device is placed on a plane surface it will measure the acceleration as 0g on X and Y axis and +1g on Z axis.

4.5 Gyroscope

The 3-axis gyroscope in the MPU 6050 also uses the same technology as that of the accelerometer that is the Micro Electro Mechanical System (MEMS). Its main role is to measure the velocities along the three dimensional space that is the X, Y and Z axis.

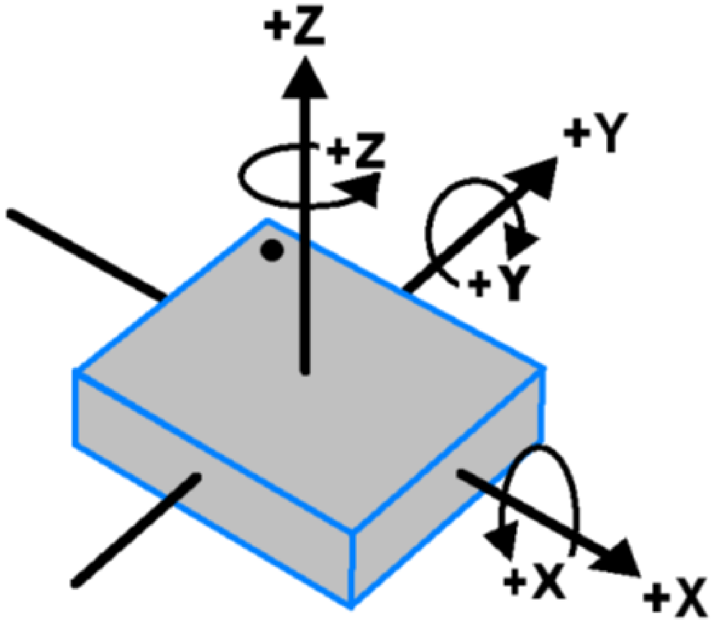

Figure 4.5: Gyroscope

It is a device that is used for measuring the orientation and the angular velocity. It is like a spinning disk on a free axis of rotation such that it can obtain any orientation on demand. According to the conservation of momentum the orientation of the axis remains unaffected while tilting or rotating. Gyroscopes works based on the Coriolis acceleration principle.

As the gyros are rotated about any axis, there is vibration caused due to Coriolis Effect which is detected by the MEM inside the MPU. The resulting voltage produced is proportional to the angular rate by amplification, demodulation and filtering. 16-bit ADC is used to sample each axis. The full-scale range of output are +/- 250, +/- 500, +/- 1000, +/- 2000. When a fork like object is set into back and forth motion. This is now help with the help of Piezoelectric crystals. Whenever you tilt or try to rotate this fork the crystals experiences forces which results in the generation of current which is amplified and then this output is refined by the host microcontroller.

Chapter 5

Result And Analysis

The model was prepared and made using the datasets of the most regularly used words. At that point, dataset for all the letters in order were joined and rearranged so as to prepare the machine with diminished change and to ensure that the model stays general and overfits less. At that point the information obtained was taken for communication via gestures of the letters or words, it went through the prepared machine and the nearest estimation was played and shown.

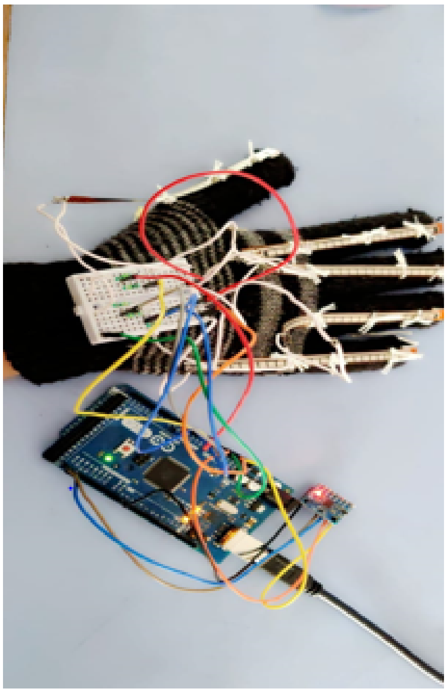

Figure 5.1: Smart Glove

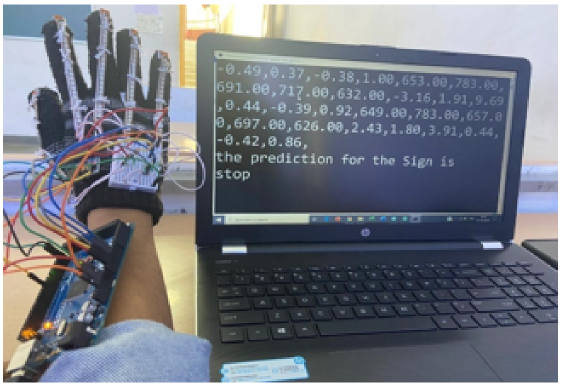

Figure 5.2: Hand Gesture and Output for Stop Sign

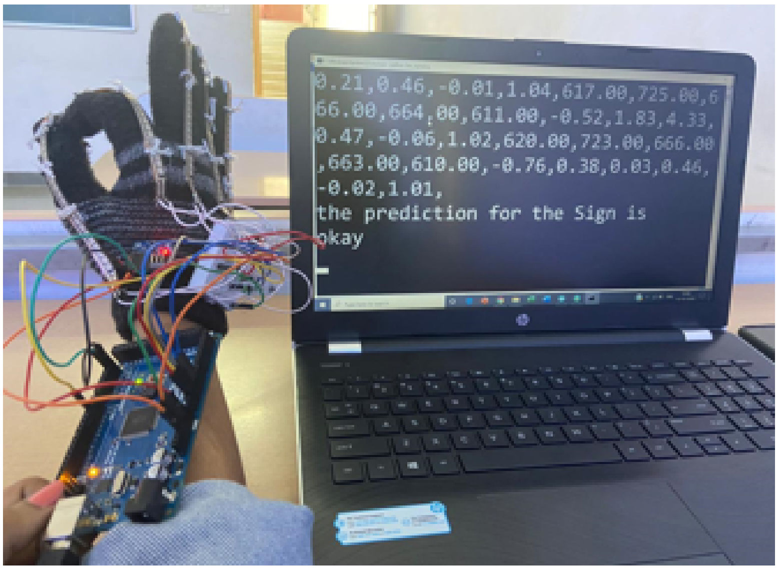

Figure 5.3: Hand Gesture and Output for Okay Sign

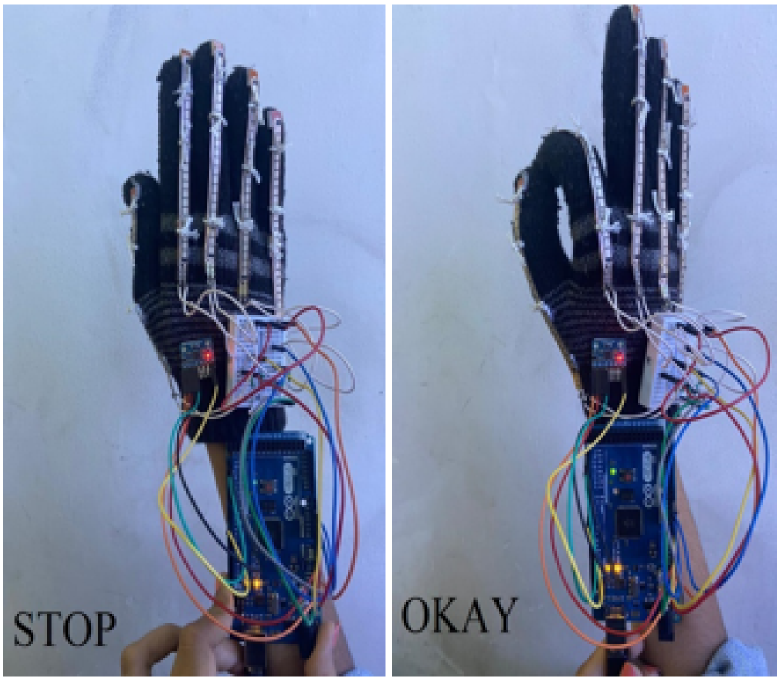

Figure 5.4: Hand Gestures for Stop and Okay Sign

Figure 5.5: Hand Gesture and Output for Help Sign

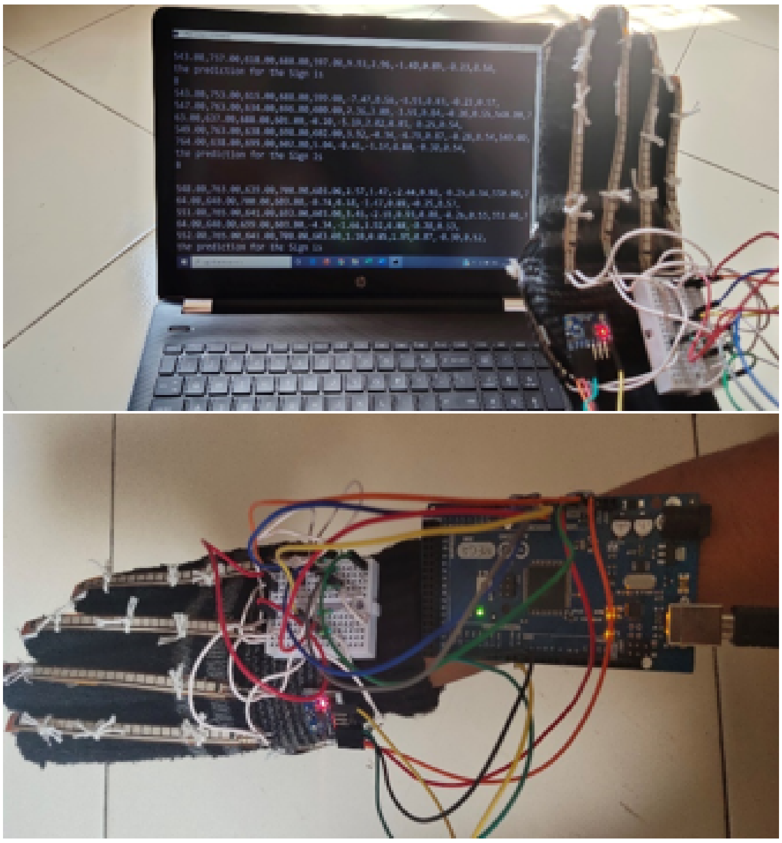

Figure 5.6: Hand Gesture and Output for letter B

Chapter 6

CONCLUSION

This paper focusses on the project about smart gloves for hearing and speech impaired people. We developed this project so that there is efficient and proper communication between the speech impaired people and the normal people. Machine learning was used to train the datasets for the sign language. Hard of hearing individuals depend on gesture based communication mediators for correspondence. Relying completely upon the translators in day to day existence for most part because of significant expenses and difficulty in finding and booking qualified translators creates a major issue for the differently abled people. Since the gestures are limited, it can lead to the misinterpretation of the alphabets during output. As the quantity of dataset builds the exactness likewise increments. Notwithstanding the issues referenced, the structured glove could help connect correspondence hole between hard of hearing individuals and ordinary population to a specific level.

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