Project Report
on

Transliterating Gloves

Submitted in partial fulfillment of the requirement
for the award of the Degree of

Bachelor of Engineering
in
Electronics and Telecommunication Engineering

by

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Academic Year 2018-19

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CERTIFICATE

This is to certify that the project entitled **"Transliterating Gloves"** is a bonafide work of **Mr. Kushal M. Jadhav, Miss Sejal M. Jadhav and Miss Gauri D. Karkhanis** under the supervision of **Prof. Manisha Ahirrao** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the Degree of Bachelor of Engineering in Electronics and Telecommunication Engineering.

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Project Report Approval for BE

This project report entitled **"Transliterating Gloves"** by **Mr. Kushal M. Jadhav, Miss Sejal M. Jadhav & Miss Gauri D. Karkhanis** is approved for the degree of Bachelor of Engineering in Electronics and Telecommunication Engineering from University of Mumbai, in academic year 2018-19.

Examiners:

1.Internal_________________________

2.External_________________________

Date:
Place:

Seal of the Institute

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DECLARATION

We declare that this written submission for B.E project entitled **"Transliterating Gloves"** 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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Abstract

There is a huge gap in communication between the deaf or dumb or blind people and normal folks. Often the method of communicating of the dead/dumb that is with the help of sign languages is misintrepreted by the normal people and hence the gap in communication. A translator is needed who can translate the sign languages to the corresponding text/ audio. This project is based on the need of developing an electronic device that can translate hand gesture or hand signs into text and speech in order to make the communication between the mute communities with the normal people. A data glove is used to convey the finger gesture of a mute person. Mute people can use the glove to perform hand gesture and the same will be converted into text as well as in speech so that normal people can understand the mute person expression. The glove is equipped with flex sensors, gyroscope and an accelerometer to measure the flexion of the fingers, to measure tilt and the rotation of the hand. The data is transmitted from microcontroller to an android app via Bluetooth module which then uses it's text to speech converter to convert the incoming text into Audio output as well as display the received text on its display. These gloves, hence build a bridge for communication between the normal people and the special ones.

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Chapter 1

Introduction

Sign language is a language which instead of acoustically conveyed sound patterns, uses manual communication and body language to convey meaning. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts. Wherever communities of deaf people exist, sign language will be useful. Sign language is also used by persons who can hear, but cannot physically speak. While they utilize space for grammar in a way that spoken languages do not. Sign languages exhibit the same linguistic properties and use the same language faculty as spoken languages do.

Hundreds of sign languages are in use around the world and are at the cores of local deaf cultures. Some sign languages have obtained some form of legal recognition, while others have no status at all. Deaf and dumb people use sign language to communicate with themselves and with common people. It is very difficult for the common people to understand this language. Though they can show their message in writing, it is not conveyable to the illiterate people. Sign language translating equipment helps in conveying their message to the common people. It translates their message in sign form to the normal understandable text or voice form. All over the world there are many deaf and dumb people. They are all facing the problem of communication

This project is an effort to overcome this communication barrier by developing a glove which senses the hand movement of the sign language through sensors and translates it into text and voice output which will enable vocally challenged people to communicate with normal people without any difficulty.

Chapter 2

Literature Survey

2.1 Image processing based language converter for deaf and dumb.

This method uses image processing for conversion of sign languages into text. For implementation of this method, we need to differentiate the fingers by placing different colour rings on them. The different modules involved in the implementation of the system are:

- Camera interfacing: To order to obtain the gesture, we need to interface a camera to obtain the frames.
- Binary Conversion: After obtaining the RGB image, it is converted to grey and then from grey to binary conversion takes place.
- Gesture Recognition: Camera is used to obtain the exact positions of the rings that are placed on the fingers and then image processing is performed using colour recognition to determine the co-ordinates of the colours.

The co-ordinates that are captured is then compared with all the previously stored images in the database and then the exact alphabet is decoded. Disadvantages of using this method is that one alphabet is decoded at a time so it takes more time for a person to communicate even a sentence. So, it is comparatively slower and hence cannot be used in applications where speed is the main constraint.

2.2 Sign language to text converter

This system aimed at developing a glove which translates gestures into text. Text is read and processed by Arduino Uno, displayed on 16x2 LCD Display. Gestures are converted into text using hand gloves. 5 flex sensors are placed on the fingers. The deaf and dumb people need to wear the glove and make the letter gesture. The main electronic board will contain the microcontroller which gets the analog values from the flex sensors. The analog values obtained is stored and then compared with the threshold and the letter is decided which is then displayed on the LCD. The drawback of this system is that it decodes the hand gestures in one letter so it takes more time to decode the entire sentence. So, it is comparatively slow and the accuracy for the signs interpreted is less as well.

Chapter 3

Problem Statement and Objectives

3.1 Problem Statement

- Communication between deaf-mute and a normal person has always been a challenging task which creates very little room for them to communicate effectively.
- Sign language is a non-verbal form of intercourse which is found amongst deaf communities in world. The languages do not have a common origin and hence is difficult to interpret.
- Our project has been designed to provide solution to these problems. We are converting sign language into text and audio form which will help deaf and dumb people to communicate effectively.
- The deaf and dumb person is largely dependent on a family because they get economically and emotional support from the family. Our project has been designed to provide solutions to the problems faced by the deaf and dumb people in real world.

3.2 Objectives

- To design and develop a system which lowers the communication gap between speech-hearing impaired and normal world.
- Build a glove device to detect sign language.
- Maximum utilization of space available on the glove so that all the hardware components can fit on it.
- Able to recognize and effectively differentiate between different gestures.
- Device should be as Portable as possible.

Chapter 4

Work Done

4.1 Procedure adopted

Our system consists of 5 flex sensors on each hand and an accelerometer and gyroscope. These sensors are used to reduce the power and cost. The flex sensors and the accelerometer and gyroscope unit, together are used to recohnize the finger and palm gestures. A block diagram of the proposed system is as shown below,

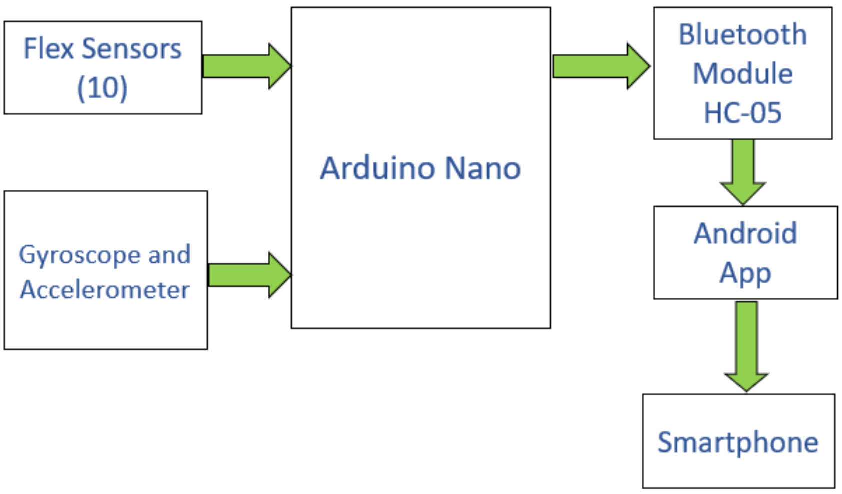


Figure 4.1: Block Diagram of proposed Transliterating Gloves system

The Arduino Nano controller is used to reduce the size of the circuit and it also provides the required number of input and output pins for the design. Ten flex sensors are used to measure the angle of bending of fingers. The flex sensors are interfaced with the accelerometer and gyroscope unit through the microcontroller. All the signals from the sensors are fed to the Arduino. So for every action the motion sensor gets accelerated and gives the signal to the controller. The Arduino nano controller matches the input signal wth the already stored, corresponding text and will show the message on the smartphone screen via the Bluetooth module. The text to speech converter application will convert the corresponding text messages into speech and audio form.

4.2 Methodology

The Language of Glove uses a similar tracking method to the other glove-based systems. Five stretchable sensors are attached to the knuckles of a leather athletic glove, one on each finger and one on the thumb. These are connected to a Ardiuno Nano board on the wrist, which generates a corresponding meaning of the Sign Language based on the position of the fingers and palm.

The code works off a binary system. The sensors are designed to change their electrical resistance when they're bent or stretched, so when a finger is straight, the device registers a 0 input, while a bent finger sends a signal of 1. The system combines these signals from all five sensors to generate a five-digit code, which corresponds with a particular letter. For example, in sign language the letter A is made by keeping the thumb straight while bending all fingers, so the code is 01111. To differentiate between similar gestures, the glove is also equipped with a gyroscope sensor. The various steps involved in the design and making of the project are as below:

- Develop a sensing network that incorporates and differentiates the different types of hand movement based on flexion, contact, rotation, and lastly translation.
- Interface the sensor network with a microcontroller, Arduino Nano.
- Design a Printed Circuit Board (PCB) that serves as the bridge between our hardware and software components, thereby allowing hand movements and sensor signals to be input to and processed by the microcontroller and the software code.
- Develop a program that recognizes sensor signals and stores those that correspond to a designated sign into a code library.

It should be noted that the objectives can be categorized into two main categories, hardware and software. Objective 1 is hardware objective, as it relates to the physical, tangible parts of the glove, while Objective 4 is a software objective and is instead focused on the glove's code development and signal processing. Objectives 2 and 3, as they relate to both the hardware andsoftware components, can be considered embedded systems objectives.

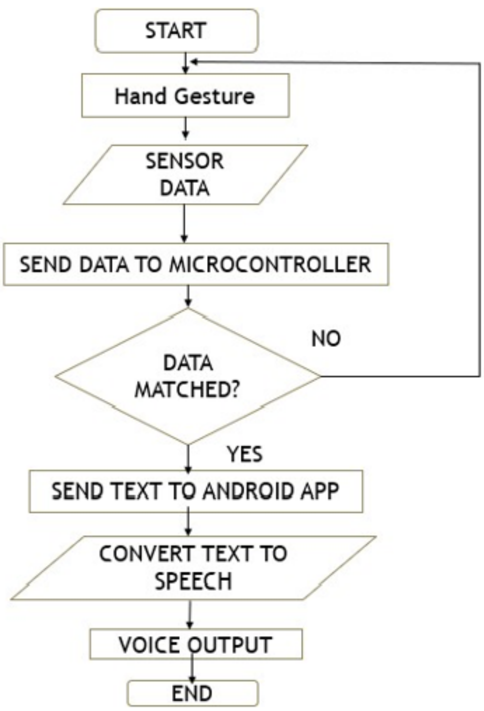


Figure 4.2: Flow chart of programming of Arduino Nano

4.3 Design

In this project, we have studied the basic signs that dumb people use to communicate with each other. As some of them are not able to talk properly they mostly use signs that are specifically used. So, it was necessary for us to first understand the sign language used by them which included various alphabets and few signs which they use in their daily life.Gesture which are the key inputs to our system, is also studied which gives different output when made different signs depending on the angle made by fingers and wrist position.

We have measured the different bending resistance values for different angles. A table describing the same is as below:

Table 4.1: Different Resistance values of finger bends against various bending angles.

Flex sensor angle range (in degrees)	Little finger	Ring finger	Middle finger	Fore finger	Thumb
0-15	1023	788-795	328-332	1021	1023
16-30	774-777	289-301	310-315	960	1020
31-45	776-780	270-290	300-305	600	1010
46-60	650-660	250-260	285-295	400	1000
61-75	530-540	220-225	250-260	350	900
76-90	385-403	200-205	240-245	200	800

Chapter 5

Component Specifications

5.1 Flex Sensor

- Operating voltage: 0-5V
- Can operate on LOW voltages
- Power rating: 0.5Watt (continuous), 1 Watt (peak)
- Life:1 million
- Operating temperature: -45ºC to +80ºC
- Flat Resistance: 25K Ω
- Resistance Tolerance: ±30%
- Bend Resistance Range: 45K to 125K Ohms (depending on bend)

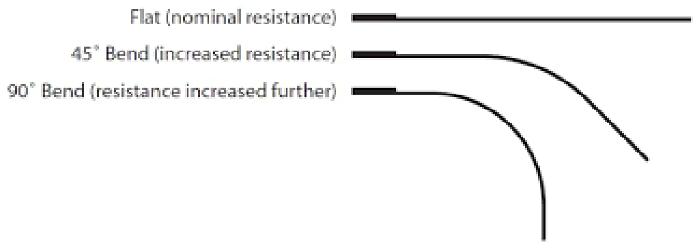


Figure 5.1: Flex sensor

5.2 Accelerometer and gyroscope

The GY-521 contains both a 3-Axis Gyroscope and a 3-Axis accelerometer allowing measurements of both independently , but all based around the same axes, thus eliminating the problems of cross-axis errors when using separate devices.

- Accelerometer ranges: ±2, ±4, ±8, ±16g
- Gyroscope ranges: ± 250, 500, 1000, 2000 °/s
- Voltage range: 3.3V - 5V (the module include a low drop-out voltage regulator)

Figure 5.2: Accelerometer and gyroscope unit

5.3 Arduino Nano

- Microcontroller Atmel ATmega168 or ATmega328
- Operating Voltage: 5 V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 8
- DC Current per I/O Pin 40 mA
- Flash Memory 16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by bootloader
- Clock Speed 16 MHz
- Dimensions 0.73" x 1.70"

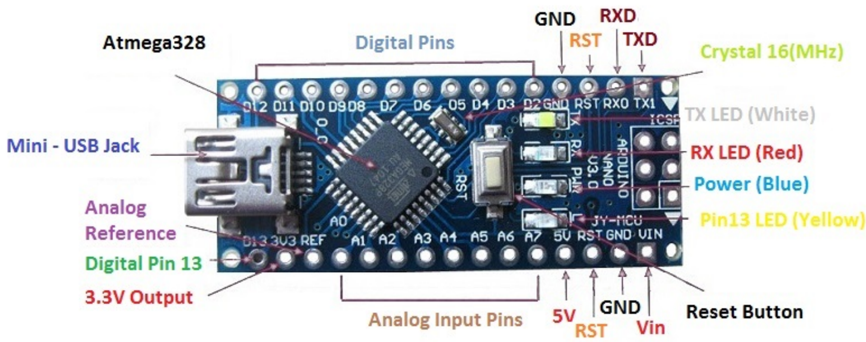


Figure 5.3: Arduino Nano

5.4 Bluetooth Module

- Serial Bluetooth module for Arduino and other microcontrollers
- Operating Voltage: 4V to 6V (Typically +5V)
- Operating Current: 30mA
- Range: <100m

- Works with Serial communication (USART) and TTL compatible
- Follows IEEE 802.15.1 standardized protocol
- Uses Frequency-Hopping Spread spectrum (FHSS)
- Can operate in Master, Slave or Master/Slave mode
- Can be easily interfaced with Laptop or Mobile phones with Bluetooth
- Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

Figure 5.4: Bluetooth module HC-05

Chapter 6

Result

We have successfully implemented both hardware and software onto the gloves. An image of the gloves is as shown:

Figure 6.1: Final designed gloves

We have measured the resistance values repeatedly, about 5-6 times and thus we have calculated and tabulated the resistance values in range. We have tabulated results for both, single handed gestures and also for gestures with two hands. The reason for setting range of resistance values is because a single gesture cannot have the same bend or the same angle for each and every person. To ensure that the gesture is interpreted properly we have shown the values in a resistance range.

A table of single handed gestures implemented are as follows:

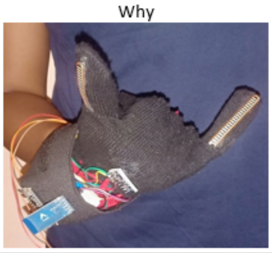
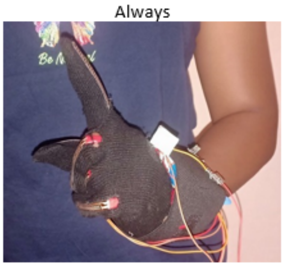
Sign	Resistance values
Hello 	Little finger: 164-183 Ring finger: 186-203 Middle finger: 301-315 Fore finger: 242-302 Thumb: 205-238
Sorry 	Little finger: 160-170 Ring finger: 207-220 Middle finger: 115-125 Fore finger: 160-170 Thumb: 205-210
Why 	Little finger: 185-190 Ring finger: 256-258 Middle finger: 157-162 Fore finger: 189-197 Thumb: 220-223
No 	Little finger: 178 Ring finger: 237 Middle finger: 147 Fore finger: 163 Thumb: 211
Always 	Little finger: 175 Ring finger: 260-275 Middle finger: 135-150 Fore finger: 175-190 Thumb: 215-230

Figure 6.2: Signs that are performed by single handed and their resultant resistance values

A table of dual hand gestures implemented are as follows:

Gesture	Resistance value of left hand finger(in ohms)	Resistance value of Right hand fingers(in ohms)
Help 	Little finger: 190-200 Ring finger: 245-250 Middle finger: 150-155 Fore finger: 220-230 Thumb: 240-250	Little finger: 190-195 Ring finger: 230-240 Middle finger: 145-150 Fore finger: 145-155 Thumb: 113-122
Family 	Little finger: 193-197 Ring finger: 240-245 Middle finger: 144-145 Fore finger: 260-270 Thumb: 223-240	Little finger: 192-195 Ring finger: 245-244 Middle finger: 139-147 Fore finger: 188-196 Thumb: 155-161
Promise 	Little finger: 148-152 Ring finger: 185-197 Middle finger: 104-197 Fore finger: 153-171 Thumb: 212-230	Little finger: 197-198 Ring finger: 225-232 Middle finger: 130-132 Fore finger: 138-140 Thumb: 110-120
Play 	Little finger: 189-194 Ring finger: 283-295 Middle finger: 159-187 Fore finger: 195-221 Thumb: 219-220	Little finger: 186-204 Ring finger: 237-241 Middle finger: 126-139 Fore finger: 152-155 Thumb: 125-135

Figure 6.3: Signs that are performed by two hands and their resultant resistance values

Chapter 7

Conclusion and Future Scope

7.1 Conclusion

The project proposes a translational device for deaf-mute people using glove technology. The proposed technique has enabled the placement of ten flex sensor, 5 tactile sensors and an accelerometer on to a glove. The results demonstrate that sensor glove design with tactile sensor helps to reduce the ambiguity among gestures and shows improved accuracy. Further the device will be an apt tool for deafmute community to learn gesture and words easily. The project can be enhanced to include two or more accelerometers to capture the orientation of hand movements once the gesture is made. This will expand the capability to translate larger gestures.

7.2 Future Scope

The project can be further developed by creating a wider database and implementing more signs. Also we can create a unique emergency sign for a user, which will give out signal during times of distress through the smartphone. The user when performs this particular sign will be read by the microcontroller as a distress situation and will give out the programmed message and also send a call or message to the authorities.

Bibliography

[1] S. Ong & S. Ranganath, *Automatic sign language analysis: A survey and the future beyond lexical meaning*, IEEE Trans. Pattern Anal. Mach. Intell., vol. 27, no. 6, pp. 873– 891, Jun. 2005.

[2] P.B. Koli, Ashwini Chaudhary, Sonam Malkar, Kavita Pawale & Amrapali Tayde, *Image Processing Based Language Converter for Deaf and Dumb*, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834/p-ISSN: 2278-8735 /2023 Dec 2006/pp. 25-30.

[3] Anuja Golliwar, Harshada Patil,Rohita Watpade,Sneha Moon,Sonal Patil & V.D.Bondre, *Sign Language Translator Using Hand Gloves*, International Journal of Electrical, Electronics and Computer Systems,Volume 2,pp.90,Issue-1,January,2014.

[4] Yasmeen Raushan, Abhishek Shirpurkar, Vrushabh Mudholkar, Shamal Walke, Tejas Makde, Pratik Wahane, *Sign Langauage Detection For Deaf And Dumb Using Flex Sensors*, IRJET Journal, e-ISSN: 2395 -0056/ p-ISSN: 2395-0072.

Chapter 8

Achievement

- Participated in *Third National Level Project Competition* held at Rajiv Gandhi Institute of Technology on 29/04/2019.
- Participated in *Technical Paper Presentation Competition* held at Rajiv Gandhi Institute of Technology on 30/04/2019.