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SIGN LANGUAGE TO SPEECH TRANSLATOR

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Abstract -

Human beings interact with each other to convey their ideas, thoughts, and experiences to the people around them. The combination of electronics & telecommunication led to many advancements in communication sector. These advancements led to better and fast communication among normal people. Other than normal, the inarticulate (special) people face difficulty to communicate normally due to sign language. The aim of this project is to develop a bridge between normal language and sign language by developing a device which can convert the hand gestures into speech. This project resolves the communication barrier among all.

Keywords—Inarticulate, signlanguage, hand gestures, communication

I. Introduction

Language is the method of human communication, either spoken or written, consisting of use of words in a structured and conventional way. There are over 65,000 languages are used for communication. The development of the most popular devices for hand movement acquisition, glove-based systems started about 30 years ago and continues to engage a growing number of researchers.

A 25years old technology from Kenya stayed determined on dealing with and solving the issues. Roy, an employee at Intel and a tutor of Oxford University has created smart gloves that converts sign language to audible speech using sensors on fingers with mobile app to transmit data.Thomas Prayor and Navid Azodi of university of Washington [2] $10000 lemelson-MIT undergraduate student. madeSignAloud gloves using flex sensors. These are the examples of people who used sensors on fingers with some kind of processors or mobile applications while one example from NIT Agartala, where they made this idea work by using image processing. In this project we are developing a system that can efficiently translate Sign Language gestures to auditory voice by considering gestures as input and processing it to get audio output with the help of embedded systems.

There are many different sign languages as, for example, British, Indian and American sign languages. Indian Sign language comes under the criteria of Indo-Pakistani Sign Language (IPSL) is the predominant sign language in South Asia, used by at least several hundred thousand deaf signers[6] Symbolic hand gestures known as mudras have been employed in religious contexts in Hinduism, Buddhism and Zoroastrianism for many centuries, although these religious traditions have often excluded deaf people from participation in ritual or religious membership..

This will help to reduce the communication gap and also such special kind of people may have brilliant ideas in their minds which could contribute in growth of certain thing which they may not be able to express. This project can provide them aid to communicate.

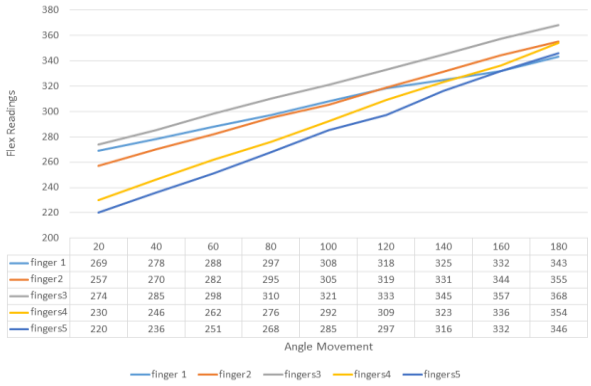
II. Methodology

A. Detection of Signs

The design of flex sensors is being used for detection of bending movement of fingers. The bending movement of each finger is divided into 9 angles which is shown in the graph and Table fig1.The orientation of flex sensors to fingers as shown in fig2.

For further explanation, if the hand is in rest position all the fingers will give negligible deflection. When the fingers are bend to obtain a particular sign the deflection will gradually increase with respect to angle of bending movement. These variations of all five finger's flex

sensors are given with respective to bending of each finger in fig1.



	20	40	60	80	100	120	140	160	180
finger 1	269	278	288	297	308	318	325	332	343
finger2	257	270	282	295	305	319	331	344	355
fingers3	274	285	298	310	321	333	345	357	368
fingers4	230	246	262	276	292	309	323	336	354
fingers5	220	236	251	268	285	297	316	332	346

Fig1.bending of finger Vs flex readings

B. Orientation of Hands

To detect the orientation of hand, accelerometer is being used. Accelerometer is a device that measure acceleration across three axes (x, y, z) to determine orientation i.e. hand gestures. The output of accelerometer is obtained in terms of angle i.e. orientation in x, y, z directions obtained in the form of analog readings.

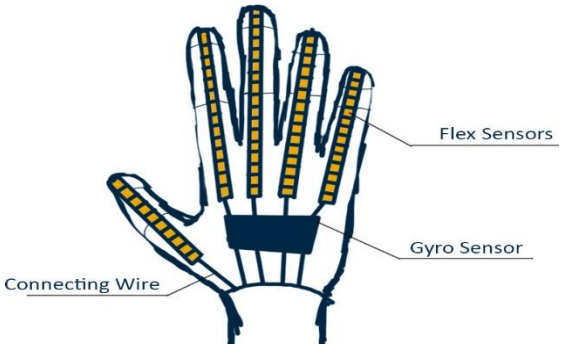


Fig2. Orientation of Flex sensors &Accelerometer

B. Wireless Communication

1.Bluetooth Module

For data sharing from left to right hand, we have used two Bluetooth modules (HC05) as, so that all the data is collected in microcontroller of right hand.

This data is transmitted by left hand Bluetooth module serially to right hand Bluetooth. This whole data of 16 bytes is given as input to the serial port of microcontroller of right hand.

2.Microcontroller

Atmega 8 is an 8-bit high performance microcontroller of Atmel mega AVR family. This is very fast and consume low power by working in different power saving modes. It is based on RISC CMOS technology. The programmable flash memory is 8K while RAM and EEPROM are 1K and 512 bytes respectively.

In the system, the microcontroller receives data from both hands serially through serial ports. Here, Microcontroller is mainly used for purpose of analog to digital converter. Afterconversion, these digital values are transmitted to Raspberry pi module3 for further processing.

The input and output are taken from outside world in the form of logic values from pins that are usually organized in the group of eight and are referred as port.It has four digital I/O ports PortA/B/C/D and pins of each labeled as P0-P7. Each I/0 port has an inbuilt task related to inbuilt peripherals.

C. Data Analysis using Raspberry pi 3

The raspberry Pi is a popular Single Board Computer it is a full packed computer in a single board. The operating system used by it is Raspbian. It has a 512 RAM,32-bit CPU, flash memory ranging from 16-64GB, inbuiltWi-Fi, Bluetooth connectivity (to serial port) and speech engine so that we can convert text to speech.

It is basically used in this project for data acquisition and data analysing. Microcontroller's output is fed to the serial port of Pi0.Raspberry pi 3 module allow us to use Espeak which will convert digital input into audio signals.

In sign language, finger movements and hand gestures are required for communication. So here we are using flex sensor on each finger for both hands and for the orientation of hand accelerometer is to be used. The output of this collaboration of 5-flex sensors and 3-axis accelerometer per hand will be given to the respective microcontroller. The microcontroller will convert these analog readings into digital form. Each hand will have 1 microcontroller, 1 Bluetooth module.The left hand Bluetooth transmits this digital values to right hand microcontroller serially while, right hand Bluetooth act as receiver. That microcontroller's output will be given to the Raspberry pi serially. Further data analysis and processing will be take place in Raspberry pi i.e. conversion of digital data into audio form. The audio output is audible with the help of speakers which is preprocessed by filter and amplifier. So in this way it will aid inarticulate

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people to convert their signs into speech (audio forms). This can be explained on the basis of block diagram given fig3.

Example- From sign table first sign is HELP where its respective data is 51116ABC52222CAC.While 51116 is a quantized output from flex sensor reading which varies from 343 to 262. This range is specifically divided in to six angles and those angles are notified in between range 6 to 1. Similarly, for the orientation of hands via accelerometer is differentiated and divided in three axes i.e. A,B,C. Now by merging these data i.e. 51116 and ABC we get 8 bytes' data of one hand. Where this data is send to the right hand where both 8 bytes of data get merged and total 16 bytes of data transmitted to the raspberry pi3 via soft serial communication

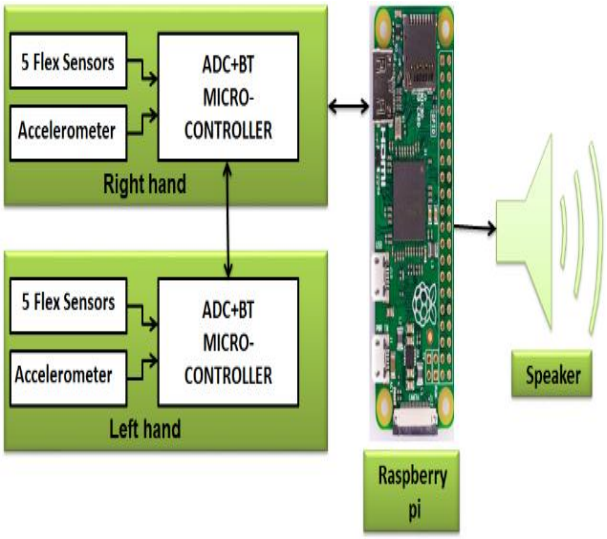

Fig3.Block diagram of Sign to speech translator

Flowchart:

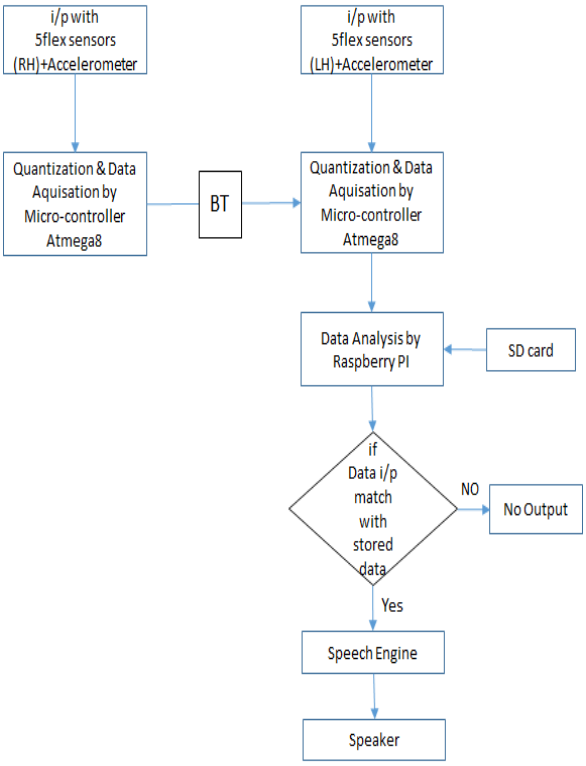

Fig4.Flowchart of Sign to speech translator

The input taken by 5flex sensors and 3 accelerometer axes per hand are quantized using microcontroller after which left hand readings transmitted serially to right hand microcontroller using Bluetooth. These combined readings now transmitted to raspberry PI where data analysis is done. These readings are compared with the readings stored in PI memory card. If it found match, then respective saved audio is played otherwise no output will obtain. These process is can be seen by above fig4.

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Sample sign table:

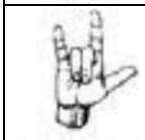
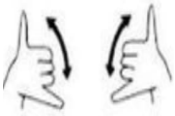
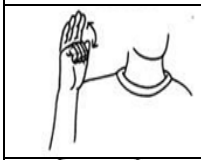
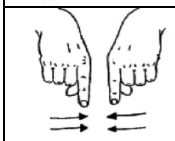
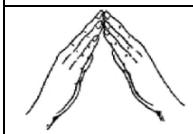
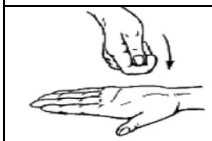
SIGNS	MEANING	READING OBTAINED
	Help	51116ABC52222CAC
	I love u	00000000 11651BAB
	Mom	00000000 11111BAB
	Dad	54111BAB 00000000
	Hello	00000000 41111AAB
	More	51116ABC 62221CAC
	play	65551ABB 16551CAB
	Goodbye	51116BAB 00000000
	Brother	65516ABC 61555BBC
	House	51111BAC 11111BAC
	Pay	5111BBA 44444BBB

Fig.5 Sign Table

III. Experimentation& Result

The sign language to speech translator as shown in the figure 6 will be very useful to the inarticulate people and will help them to communicate with the common people. This project provide aid to these special and will help them to express their ideas, thoughts.

Taking the example of Hello Sign, if someone does the hello gesture then the corresponding terminal readings which are already observed and saved for that particular sign, will be obtained and we will get the audio output.Similarly, for each of the signs, output have been obtained.

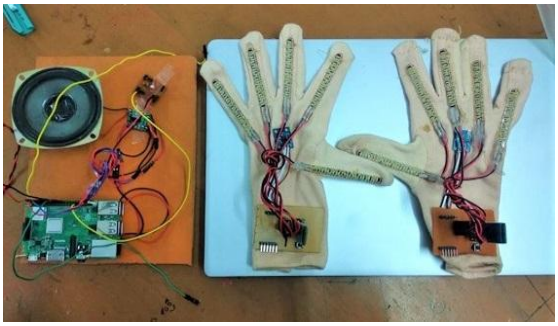


Fig. 6 Proposed system

IV. Conclusion

The sign language to speech translator will be very useful to the inarticulate people and will help them to communicate with the common people. This project provide aid to these special and will help them to express their ideas, thoughts.

Detection of sign is done by only hand gestures while facial expressions are not detected yet, but modifications on facial expressions can be further implemented.

V. Acknowledgement

We express our hearty gratitude towards Electus Technologies Pvt. Ltd. who provided us proper guidance and conceptual knowledge regarding hardware and software needed for the project. We also thank to Mr.C.S. Gode, project coordinator for providing constant encouragement and support for the project.

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