ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 10, April 2014

Multiple Sign Language Translation into Voice Message

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Abstract*-----The paper presents the solution for deaf and dumb people generally dumb people use sign language for communication, but they find difficulty in communicating with others who don't understand sign language. This project aims to lower this barrier in communication. It is based on the need of developing an electronic device that can translate sign language into speech in order to make the communication take place between the mute communities and the general public as possible. A Wireless data glove which is a normal cloth driving glove fitted with flex sensors is used along the length of each finger and the thumb. Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have a corresponding sign in that sign language. In this project, Flex Sensor plays the major role, Flex sensors are the sensors whose resistance changes depending on the amount of flexion experienced by the sensor. Here the device recognizes the sign language Alphabets and Numbers. It is in the process of developing a prototype to reduce the communication gap between differentiable and normal people. The program is in embedded C coding. Arduino software is used to see the working of the program in the hardware circuitry which is designed using microcontroller and sensors.

Keywords: **Sign Language Recognition, American Sign Language, Indian Sign Language.**

I. 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 equipments helps in conveying their message to the common people. It translates their message in sign form to the normal understandable text or voice form. Our project is one such effort in developing a glove which senses the hand movement of the sign language through sensors and translates it into text and voice output. All over the world there are many deaf and dumb people. They are all facing the problem of communication. In order to overcome this communication barrier, we are developing a device which translates their sign language into voice form. This conversion is done using microcontrollers which takes the input from the sensors which senses the hand movement of signing. The programming of this device is done in C language.

II. RELATED WORK

The recorded history of sign language in Western societies extends from the 16th century, as a visual language or method of communication. Sign language is composed of a system of conventional gestures, mimic, hand signs and finger spelling, plus the use of hand positions to represent the letters of the alphabet. Signs usually represent complete ideas, not only individual words. Most sign languages are natural languages, different in construction from oral languages used in proximity to them, and are employed mainly by deaf people in order to communicate.

A. Development of Sign Language

Sign Languages have existed since deaf people have been around. Universally, where there are deaf communities, sign languages can also be found. The written history of sign language began in the 17th century in Spain. In 1620, Juan Pablo Bonet published Reducción de las letras y arte para enseñar a hablar a los mudos ('Reduction of letters and art for teaching mute people to speak') in Madrid [1]. It is considered the first modern treaty of phonetics and speech therapy, setting out a method of oral education for deaf children by means of the use of manual signs, in the form of a manual alphabet to improve communication among and with deafies.[6] From Bonet's Alphabet, deaf children at Charles-Michel de l'Épée's school has adopted and adapted into what is now the French manual alphabet. The French manual alphabet was published in the 18th century, which has arrived basically unchanged until the present time. Standardized sign languages have been used in Spain and Italy since the 17th century and in France

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since the 18th century in Deaf education. [7]Old French Sign Language was used in Paris' deaf community, long before Abbé Charles Michel de l'Épée came and started his deaf school. However de l'Epee has learned the language from deafies there and introduced Signed French to his school, using the signs learned and adapted. These languages were always modeled after the natural sign languages already in use by the deaf cultures in their area of origin, often with additions to show aspects of the grammar of the local oral languages. In 1755, Abbé de l'Épée founded the first public school for deaf children in Paris. His lessons were based upon his observations of deaf people signing with hands in the streets of Paris. Synthesized with French grammar, it evolved into the French Sign Language. [2]Laurent Clerc, a graduate and former teacher in Paris, went to the United States with Thomas Hopkins Gallaudet to found the American School for the Deaf in Hartford. The 18th permanent school for the deaf was established in Hartford, Connecticut; others followed. In 1817, Clerc and Gallaudet founded the American Asylum for the Deaf and Dumb (now the American School for the Deaf). In 1864, a college for deaf people was founded in Washington, D.C.

III. DESIGN METHODOLOGY

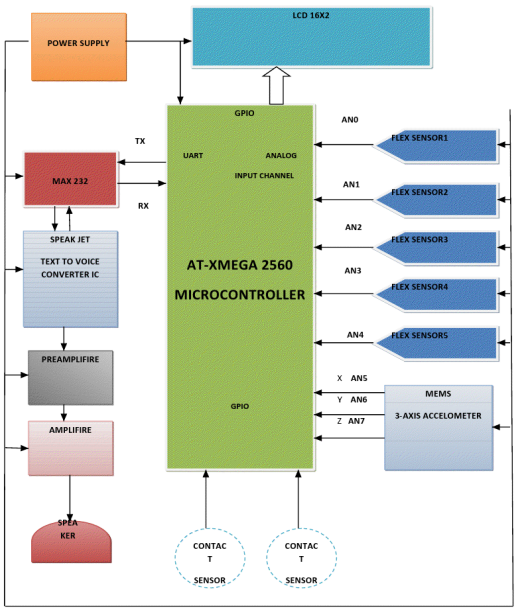

Fig 1: Block diagram of Automatic finger sign recognition

This system consists of AT-Xmega 2560 microcontroller, which operates on 16MHz frequency. The module consists of flex sensors which are fabricated with resistive material which varies depending on the bend. There are 5 flex sensors and they are located on each of the finger. To differentiate the words module uses 3-axis MEMS accelerometer which provides 3 axis they are x, y, z axis tilts. For still more efficient character recognition we are using 9 contact sensors. There are 26 alphabets in English and commonly they use 10 numbers i.e. 1-10 in ASL. All the alphabets and numbers are of different orientation. Microcontroller will be continuously scanning 8 analog channels at the rate of 10kps at the resolution of 14 bit. The above mentioned scanning method is called successive approximation type scanning. Then microcontroller receives the ADC value which will be further used for comparison and processing. For each character it checks ADC and tilted value with the closed contact and recognize the corresponding characters. This information is conveyed to the other users with the help of a text to voice convertor for audible information and LCD for visible information and same process will be repeated all the time. The module works in two modes i.e. Alphabet mode and the Number mode. Here we use a switch to transit one mode to another.

A. Flex sensor

Flex sensors are sensors that change in resistance depending on the amount of bent on the sensor. They convert the change in bent to electrical resistance-the more the bent, the more the resistance value. They work as variable analog voltage divider. When the substrate is bent the sensor produces a resistance output relative to the bent radius.

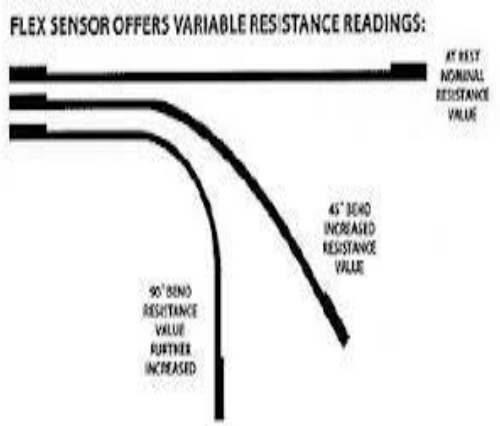

Fig 2: Flex sensor

B. Microcontroller Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 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. [1]It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

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The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the boot loader), 8 KB of SRAM and 4 KB of EEPROM.

Fig 3: Microcontroller Arduino Mega 2560

C. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations .

Fig 4 : 16X2 LCD display

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. [4]The data is the ASCII value of the character to be displayed on the LCD.

D. Speaker Jet

The Speak Jet is a completely self contained, single chip voice and complex sound synthesizer. It uses Mathematical Sound Architecture tm (MSA) technology which controls an internal five channel sound synthesizer to generate on-the-fly, unlimited vocabulary speech synthesis and complex sounds.

E. Accelerometer

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3GHz. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

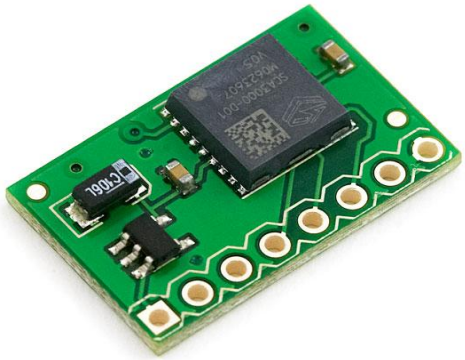

Fig 5: Accelerometer ADXL335

F. MAX 323

The MAX232 is an integrated circuit, first created by Maxim Integrated Products, that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. [1]The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V. The later MAX232A is backwards compatible with the original MAX232 [3]but may operate at higher baud rates and can use smaller external capacitors – 0.1 µF in place of the 1.0 µF capacitors used with the original device. The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5 V.

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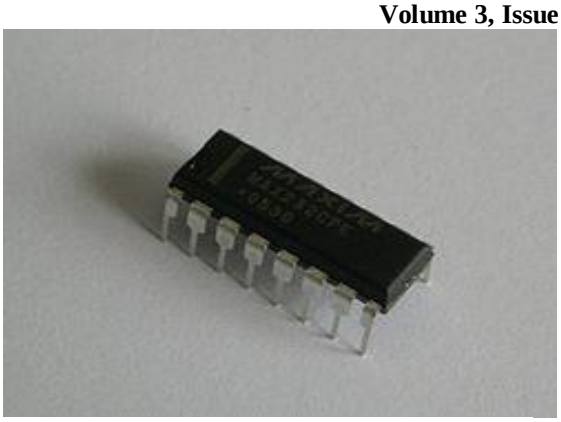

Fig 6 : MAX 323

G. Amplifier

The LM324 series are low–cost, quad operational amplifiers with true differential inputs. The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 32 V. The output voltage range also includes the negative power supply voltage.

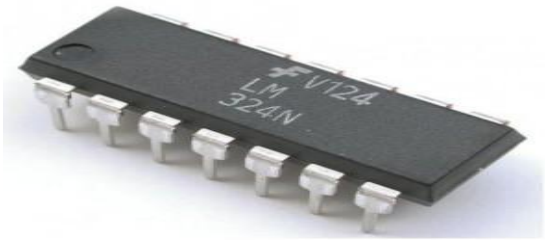

Fig 7: Amplifier IC LM324

IV. RESULTS

This chapter discusses about the result of the project. It consists of results and necessary outcomes of the project implementation.

Experimental observation consists of the following steps:

Step 1: This is the initial display when the system is powered up.

Fig 8: Initial display

Step 2: After the hand gesture of alphabet T, this is the display we get on LCD alphabet T.

Fig 9: Displaying alphabet T

Step 3: After the hand gesture of alphabet K, this is the display we get on LCD alphabet K.

Fig 10: Displaying alphabet K

Fi 11: Displaying number 7

Fig 12: Displaying number 2

V. CONCLUSION

This is the useful innovation which is extremely beneficial for mute people. By using flex, contact sensors and accelerometer we can find the hand gestures with at most efficiency. By using this method, the communication gap between the mute people and the normal people can be reduced. It can also be enhanced in the following applications such as,

- Automatic calibration.
- Still optimizes size
- Battery power usage.
- Multiple words and numerical recognition with gesture based control.
- Multiple language interfaces.
- Making system waterproof.
- Advanced algorithms designs will be recognized fast.

ISSN: 2277-3754
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- In hospitals for a patient.

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