

Real Time Sign Language Number Recognition System

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Abstract- This project is mainly stands the possibility of recognizing sign language gestures using sensor gloves. Previously these techniques are used in games or in applications with custom motions or gestures. This project explores their use in Sign Language recognition. This project uses a sensor glove to capture the signs of Sign Language execute by a user and interpret them into sentences of English language. Artificial networks are used to identify the sensor values coming from the sensor glove. These values are then categorized in 24 alphabets of English language. So, deaf-dumb people can write complete sentences using this application or Project. This project aims to understand for deaf-dumb people to communicate through hand talk glove which is fitted with flex sensors. So that it would be easy for those people to communicate with others. Here, we use flex sensors to get a stream line of output data which varies with the level of bend made by the fingers. These sensors works on variation of resistance when we bend fingers and this resistance variation depends on the amount of bend of the sensor. The change in bend is equally proportional to electrical resistance. Means – The more the bend, the more the resistance value. The output which we get from Flex Sensor will be converted to digital output by using Microcontroller and gives voice response through speaker. In this project, the hardware components that mainly used are – Arduino Board which is integrated with Microcontroller (ATmega328), Flex sensors, Speech IC, Voice IC, LCD Display, Power Supply. And software components that mainly used are – Arduino Uno IDE.

Keywords- Microcontroller, aurdino, flex sensor, sign language recognition, number system recognition.

I. INTRODUCTION

In present usual life, the communication between a mute and normal person causes a serious problem when compared between blind normal visual people. Deaf-dumb people can't talk and hear freely as blind people do. Hence the Sign Language has been introduced to make deaf-dumb people more understanding based on hand gestures.

Sign Language is a language which essentially uses manual communication to convey meaning for deaf-dumb people. This language can also be called as Oral Language

which depends on sound and linguistics. This can involve simultaneously combining hand shapes, and direction movement of the hands, arms or body. This language is the most widely used language in the world. It's a linguistically complete and natural language and is the native language of deaf-dumb men, women and for children as well. In this language, we use sensor gloves and are made with cloth in general, and are fitted with sensors on it which are called as Data Gloves and these are called as heart of the project. Deaf-Dumb communication requires interpreter who will convert hand gestures into audio speech. As shown in figure 1.1, gesture in a sign language for different numbers is a unique and pre-defined movement of the hands with a specific shape made out of them. Gesture Recognition has been categorized into two types and they are as follows: VISION BASED and SENSOR BASED. Vision Based method includes precise position of gestures and complex algorithms for data processing and which is the main drawback of this method. Where as in Sensor Based method, it offers greater mobility compared to Image processing.

In general, gestures plays important role in our daily activities. Gesture recognition refers to recognize meaningful expression of motion by a human which involves face, hands and arms etc...And by which means it helps to identify the maximum gesture based on hand movement. Sign Language has been implemented, wherever deaf-dumb community exists. It's a language which user hand gestures and body movement to convey the meaning with respect to deaf-dumb people. Human communicates with each other by conveying heir ideas and thoughts. But the only way of communication can happen between deaf-dumb people is through SIGN LANGUAGE. By this sign language, they can communicate with normal people as well, as routine. But still they need to come across some difficult situations or areas, when it comes to banking, hospital etc...

Some of the sign language for numbers is shown in below figure1.











0	1	2	3	4
				
5	6	7	8	9
				

Figure 1. Sign Gestures for Numbers.

The main goal of this project is to accommodate a system which can efficiently translate sign language into text information. A database will be prepared or maintained to identify the gesture depends on the range varies.

II. LITERATURE SURVEY

Sign Language Recognition using image Processing is a language which helps deaf-dumb people for communication. Sign Language Recognition is a language which will provide a platform to understand the way of communication between deaf-dumb people and normal people. This system/language is being used to communicate with deaf-dumb people for which there is some training required for normal people. But untrained people can't communicate with deaf-dumb people without having proper knowledge of this sign language. This language will be used by deaf-dumb people with normal people more fluently.

Sign language mainly depends on physical actions which is nothing but using hand gestures and eye visibility further by means to communicate with deaf-dumb people. These people can express their way of communication or feelings with different types of hand gestures or movements and hand shapes. And the goal of this system or language is to convert those hand gestures or shapes into proper text or speech format by using LCD display and speaker.

As shown in figure 2 the image of hand gesture is used for Sign language recognition using Image processing method is an advanced language in recent years, where in automatic sign language conversion has been developed to make it easier for understanding. In this method, researchers have developed some automated tools based on coding to convert sign language into Text or speech format. The method we used here is VISION BASED method. In Vision based Image processing system, a web camera will be used to capture the images of hand shape. After capturing the image, image separation will be done. After separating the image

section captured, palm and finger will be extracted from the image. Different hand motions like half closed, semi closed and fully closed shapes will be detected.



Figure 2. Image of Hand Gesture.

III. PROPOSED METHOD

In general, the communication between deaf-dumb and normal people is always a tricky task. It's quite difficult to understand sign language to normal people which is used by deaf-dumb people. Sign Language is a non-verbal form of communication method. This method is found to make the communication easy for deaf-dumb people. This project/technique is used to get rid out of the communication barrier between normal and deaf-dumb people by developing an Embedded System code which will translate the hand gestures into combined content/transcription and verbal format without any help of special sign language interpreter. The main goal of this approach/method is to translate the sign language into text and voice/vocal format. A database will be prepared/ existed to identify the gestures of hand glove depends on the amount of fingers bent. This method is planned to interface flex sensor with Arduino board to convert the output form of test and speech. This method consists of a hand glove which will be wearing by deaf-dumb person to make communication easy with normal people. It will translate the hand gestures to equivalent words by using Flex Sensor and Arduino board. The signals are converted to digital data by using electronic circuits and Microcontroller ATmega328. The Microcontroller matches the binary combinations with the data given in the lookup table of the databases and produces the output signal in the form of speech. The output of this method will be spoken/displayed using the speaker and LCD.

The below figure 3 shows the block diagram of Hardware system of this method. This block diagram contains 5 Flex Sensors which are connected to Microcontroller ATmega328 which is integrated in Arduino board. Here we use LCD for output display in text format and Android mobile to get the output in verbal/speech format. Android mobile will get the output through wireless communication which is connected via Bluetooth. And power supply block is there and

provides the required power supply for this system. As shown below microcontroller plays an important part in the block diagram.

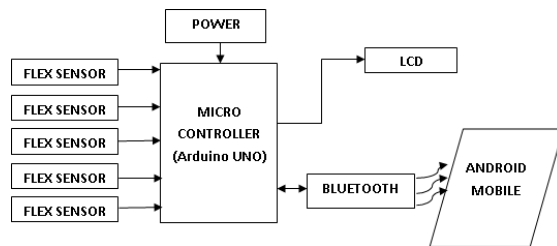


Figure 3. Block diagram of Hardware system.

The above figure 3.1 shows the block diagram that contains 5 Flex sensors, Arduino UNO board, LCD and wireless technology (Bluetooth). The functioning is as follows, Arduino UNO reads the data of flex sensor and sends the information to PC when user makes the gesture and the output will be heard through speaker. In Arduino UNO board, we use a Micro-Processor AT mega 328P where we dump the software/algorithm. We can say, this micro controller is the heart of this system/method. And the output message will get displayed through LCD and voice output can be heard through smart phone speaker, which is nothing but Android Mobile. This system uses very low power of 3.3V to 5V.

IV. RESULT AND DISCUSSIONS

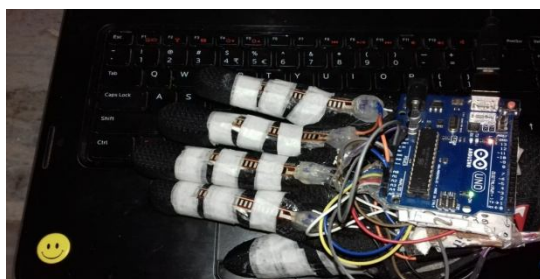


Figure 4. Sign Language Number Recognition Hand Glove.

As shown in above figure 4, it's a portable hand glove which we are using to generate different signs for numbers. This glove is fitted with Arduinouno board which is interfaced with flex sensors for getting sensor values, and with LCD that displays the sign values and also signs based on program uploaded to the Arduinouno board.



Figure 5. Hand Glove Connected to System

Table 1. Percentage of Recognition of numbers.

	ZERO	ONE	TWO	THREE	FOUR	FIVE	SIX	SEVEN	EIGHT	NINE	% of recognition
ZERO	9	1	0	0	0	0	0	0	0	0	90
ONE	0	10	0	0	0	0	0	0	0	0	100
TWO	0	0	10	0	0	0	0	0	0	0	100
THREE	0	0	0	10	0	0	0	0	0	0	100
FOUR	0	0	0	0	10	0	0	0	0	0	100
FIVE	0	0	0	0	1	9	0	0	0	0	90
SIX	0	0	0	0	0	0	10	0	0	0	100
SEVEN	0	0	0	0	0	0	0	10	0	0	100
EIGHT	0	0	0	0	0	0	0	0	10	0	100
NINE	0	0	0	0	0	0	0	0	0	10	100
										Avg	98

As shown in above figure 5, the Hand Glove that is connected to system through data cable. Here we can read five flex sensor readings through serial monitor. Here Arduino IDE software tool 1.8.4 plays an important role where code is verified, compiled and uploaded here, and after this the code is uploaded to Arduinouno board.

The table1 shows the percentage of recognition which is calculated after trying ten times for each number and the final average is 98 percent. And this is the final table for recognition of numbers. The above table shows the final recognition table which is calculated after calculating the percentage for numbers zero to one.

V. CONCLUSION

The only language is the sign language which breaks the barrier between mute and normal people, in this project, it helps the deaf and dumb people to communicate with outside world. the current algorithm or software used in this method had no impression for multiple gestures at a time and has not been ideally regulated. There can be many optimizations, which are possible for the improvement of this method. Although it's not a completed method by using the algorithm/software and the wireless technology used, it has proven that this method can translate the signs of language. And this method has a wide range of possibility to get developed into advanced technology.

VI. FUTURE ENHANCEMENT

Sign language recognition is the only way of communication or deaf-dumb people to interact with the normal people who lack the knowledge of sign language. This method of communication or recognition has the capability to minimize the communication hurdle by introducing an automated translator and converting sign language directly into vocal and textual format for the understanding of normal people using various flex sensor and ATmega 328. The input data glove detects the hand gesture done by the deaf-dumb person wearing it and provides the analog input to the microcontroller for further analysis according to the database and the final output is observed on the LCD display and the speaker. Thus, hand gesture can be automatically converted with the help of this system into understandable format for the normal person.

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