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TALKING HAND: SPEAKING SYSTEM FOR MUTE PEOPLE

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ABSTRACT

The practical way to share the ideas, thoughts, information in form of verbal and non-verbal message is communication. But in our country approximately 2.78% people can't speak. So for them gesture or sign language is very important contrivance to communicate. The normal people of our society are not capable to be aware of the sign language without the translator. To overcome this limitation, we proposed a new technique 'Talking Hand Speaking System' using microcontroller and sensors which is helpful to communicate between normal people and dumb people.

KEYWORDS: Gesture, Arduino, Flex Sensor, Lcd Display, Speaker.

INTRODUCTION

To make the interaction easy between normal people and dumb people without any medium is essential, where there are 2.78% of people in India are dumb. So, to lower this barrier, implementing a machine for them is essential and several researches have been done so far to convert sign language into understandable messages [1]. Actual aim of the project is to ensure normal communication by implementing a system that will break the barrier of communication and will translate gestures of mute people into speech which are audible and understandable by normal people, mainly using gloves, flex sensors and accelerometer [2].These days, researchers are trying to develop artificial prosthetic hands which can interpret the behavior of a human hand and they are mainly focusing on hand gestures [3].Sign language is a non-verbal form of communication method which is found among all deaf communities in world. As the accuracy of using the idea of image processing and accelerometer is very less, so we are using here flex sensors and accelerometer for gesture recognition to increase the accuracy and to make the system more efficient than the previous ones [4]. Gestures are created by moving hands and its fingers in specific directions and for each hand gesture, a signal is produced by the sensors and corresponding to that gesture the system matches it with pre-stored inputs in the SD-card [5]. Often it becomes an issue for a normal person to chat with a mute person, and an interpreter is required to orchestrate, which is another issue, because they are not available always [6].

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So, this system is made to enable the mute people to communicate effortlessly with others and to allow them learn new things effectively. It can be used at classrooms, where it will help to create a seamless communication, as the system will provide diverse kind of sign languages [7, 8]. The system is portable and allows two way communications. The main component in the project is flex sensors. Each sensor is used for each finger and they are connected to different pins of Arduino UNO, which is mainly the controlling unit. Further they are connected with Bluetooth module, which is then connected to the speaker. Audible voice and messages, both are available in this system [9]. As, normal people generally do not understand sign languages, so, the mute people face problems in every places like bank, presentations, booking counters and so on [10]. By using this system the mute people would be benefited and the obstacle between them and the normal people will be diminished, which will be indeed great achievement for mankind [11].

LITERATURE SURVEY

G.Rao et al. [1] said that it's very difficult for the mute people to convey their message correctly to others. Since every person is not trained in hand sign language the communication becomes more difficult. Some of the solutions regarding this problem are B-Spline approximation, Real Time continuous Gesture recognition (RTC), Motion Tracking network (MTN) etc. V. Padmanabhan et.al. [2] Described that the main categories of gesture recognition are- i) vision based ii) detector based. Between this the detector based technique provides better quality.Safayet Ahmad et al. [3] briefed that in recent years researchers are focusing on hand gesture detections and had become popular for developing applications in the field of robotics and extended in the area of prosthetic hands which can accurately imitate natural behavior of humans.D. Patil et al. [4] said that in the past this project was implemented with the concept of image processing and accelerometer. But then drawbacks arose as in image processing for capturing hand gestures user has to keep his hand for a specific period of time in front of the camera. The accuracy for image processing is up to 30-40%.This accuracy is increased by using flex sensors. A. H. Ansari et al. [5] explained that a device that converts hand gestures to auditory voice is called Deaf Mute Communication. Gestures are static structure of hand to depict a particular message. Channaiah C K et al. [6] commented that to overcome this problem we have tried to come up with a hand gesture recognition system. This system that will automatically recognize the hand gestures and will convert into corresponding speech output so that a dumb person can communicate with other people. Some of the earlier system are follows:- a) Hand Gesture to Speech Conversion using MATLAB:- This system not only automatically recognize the hand gestures but also convert that into corresponding output speech. It has been developed using skin color segmentation. A camera is fixed with the computer to take images of gestures. Image and feature algorithm is used recognize gestures. b) Sign Language to Speech conversion: - In this system flex sensor based gesture recognition module is developed to recognize English alphabets and few words. c) Sign Language Recognition System using PCA: - Signs are captured in this system by a web cam. Those signs are preprocessed for feature extraction using HSV color model. Then by the Principle of Component (PCA) algorithm the obtained features are compared. Aditya C et al. [7] said that smart gloves are introduced now. Microcontroller is used for different changes in the information from flex sensors. Rishad E K et al. [8] narrated that image processing is used as a basic technique with Raspberry pi2 as the processing platform. It is already known that Hue, Saturation and value of human hand is in the range of 0-30, 30-180 and 60-255 respectively. S. Mishra et al. [9] explained that another system is proposed with 4 flex sensors connected with

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different pins of Arduino UNO which is the controlling unit. P. Bhat et al. [10] described that other implemented modules of the proposed system are: - i) Real-Time Hand Gesture Recognition Via Finger Emphasized Multi-Scale Description ii) Real-Time Hand Gesture Recognition Using Finger Segmentation iii) A color fingertip-based tracking method for continuous hand gesture recognition. A. Jain et al. [11] commented that system using MATLAB is less costly, compact, and flexible and consumes less power.

WORKING PRINCIPLE

Many ways of communications are used between human and computer, one of them includes using gesture which is considered to be one of the most natural ways in a virtual reality system. Because of its intuitiveness and its capability of helping the hearing impaired and speaking impaired. Hand gestures enable deaf people to communication during their daily lives rather than by speaking. In today's world, there is a continuous need for automatic appliances with the increase in standard of living; there is a sense of urgency for developing circuits that would ease the complexity of life. This project is designed and developed to help the deaf and dumb people in their needs. Speaking system for them make the aware about the needs of disabled. The person should know the corresponding hand gestures which are also used in our system according to actual hand gestures manual used by disabled people. When those hand gestures are given, the Arduino will give out the sound signal corresponding to the gestures. Speaking system has leads to indicate which patient is in need. Now first we are going to describe the working principle of each section of our system and the full system functionality.

GLOVE

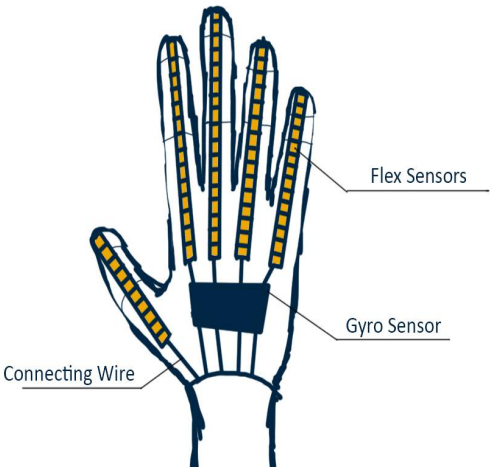

Figure 1.Gloves with Flex Sensor [11]

Data glove consists of 2 detectors; flex sensors and measuring device sensor which is accelerometer sensor here. The output of the measuring device sensors is detected by the lean detection module, whereas the output of the flex sensors and therefore the overall gesture of the hand square measure detected by the gesture detection module. Speech Synthesis module speaks the message severally to deal with received by it.

FLEX SENSOR

Flex sensors are resistive carbon parts. When bent, the device develops a resistance output correlative to the bend radius. The variation in resistance is just about 10kΩ to 30kΩ. A global organization flexed device has 10kΩ resistance and once bent the resistance will increase to 30kΩ at 90^{o}. The device incorporates within the device employing a potential divider network.

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The potential divider is employed to line the output voltage across 2 resistors connected nonparallel as shown in Figure. The electrical device and flex forms a potential divider that divides the input voltage by a quantitative relation determined by the variable and glued resistors.

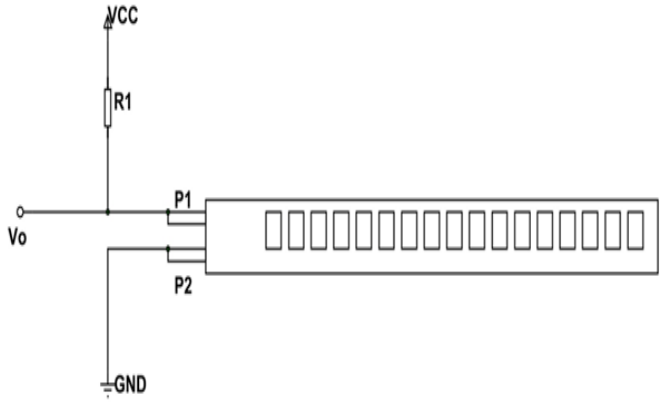

Figure 2.Voltage Divider circuit for Flex Sensor [12]

ACCELEROMETER SENSOR

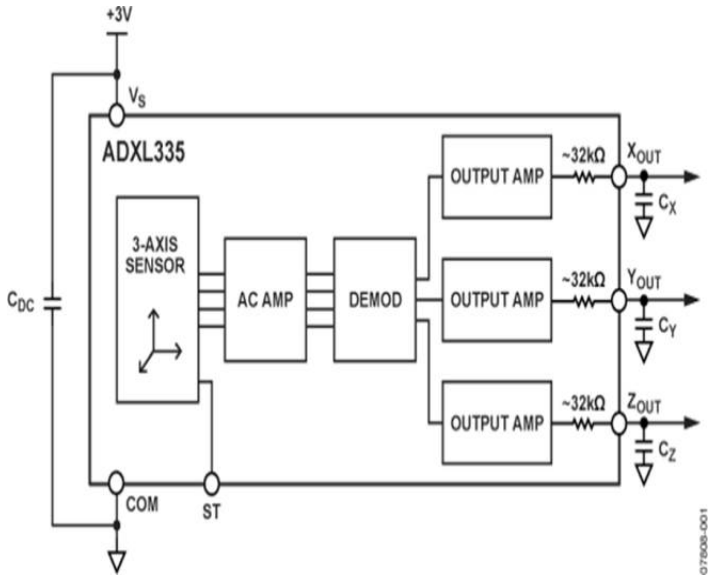

Figure 3.Circuit for Accelerometer ADXL335 [13]

Accelerometer within the Gesture Vocalized system is employed as a tilt sensing element, which checks the tilting of the hand. ADXL335 measuring system as shown in Figure. 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 ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock or vibration.

SPEECH SYNTHESIS

On the idea of this comparison the Arduino involves acknowledge that that gesture will the hand build. Quickly the Arduino is aware of that that knowledge is distributed by the flex sensor module, and what that means of this knowledge is. That means implies that the Arduino is aware of, if the hand is creating some outlined gesture and what ought to the system specification. The last step of the system is to convey voice to every outlined gesture. For this purpose, a speech

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synthesizer is employed. Every word is consisted of some explicit phonemes and just in case of Speech synthesizer every word has some different values of flex and accelerometer sensors. This value is to be sent to the Speech synthesizer and SD card module, to form the speaker, speak that individual word. Currently these values area unit already hold on within the Arduino. So far, the Arduino is aware of what the gesture created by the hand, and what ought to be expressed against it. The Arduino sends the values of those sensors to represent the allophones of the word to be spoken. Thus, the output is expressed by a speaker module.

SYSTEM FUNCTIONALITY

When power is ON, the position and orientation of hand is obtained from the data glove that consists of five Flex sensors on fingers (Thumb, index, middle, ring, and little finger) and one accelerometer of three outputs (X, Y, and Z positions). Tilting of the palm can be captured by the accelerometer where Flex sensors can measure the bend of the five fingers when making a sign. So, different combinations are made with the bending of the flex sensors creating different resistance combinations for the output pin of the Arduino to exhibit different entity. When the user performs a gesture/letter, signals coming from the sensors are amplified via a dedicated amplification circuit to each signal, and then captured by the Arduino which convert the analog signals to digital values through its 8-channel ADC. These values are formatted into a simple state matrix: five values for the Flex sensors, one for each axis of the accelerometer. As a result, each letter in the American Sign Language will have a specific digital level for the five fingers and the three axis of the accelerometer. Each level is represented by a value between 0 and 255; an interval of ± 3 levels should have been taken into consideration in case the user could not keep his hand steady. Then according to those values of both sensors a particular voice is indicated and that voice should be recorded and stored in a SD card module which is further connected to Arduino. For wireless version of speaker, Arduino is connected to Bluetooth module HC - 05; which is further connected to Bluetooth speaker/mobile phone. We can also connect the speaker with the Arduino by wire also. The flex sensor will give input to Arduino with the bending of the fingers of the person resulting in the change of the angles of the flex sensor hence changing the resistance will trigger the Arduino to give the relevant output as per the code we have written i.e. which combination of resistances will give which entity as my output. Further, when I will have the output, the speaker which is connected to the Bluetooth module will give the speech signal as my output. To express the output, we also using a LCD monitor to show the word visually which dumb people want to say for the deaf people because they cannot hear the sound of the speaker. So by representing the output by LCD screen they can comprehend those words easily.

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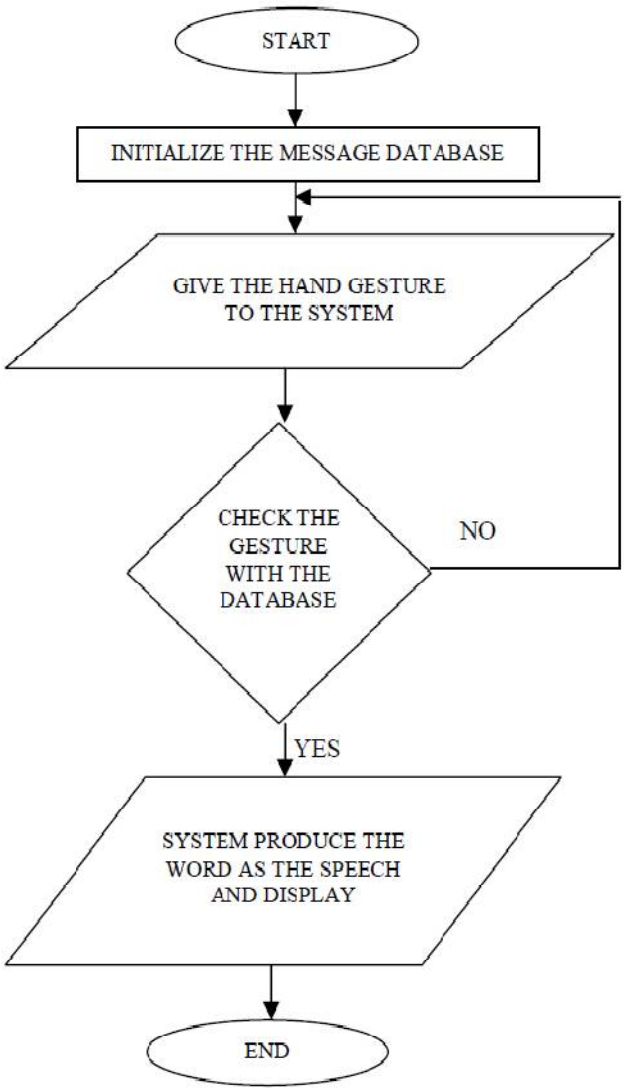
SYSTEM FLOW CHART



RESULTS

This section provides the results of our proposed system. As the flex sensors are placed in every finger of the hand for that reason in the below table the value of the flex sensors and accelerometer sensor are displayed respect to the particular word or letters.

Table 1.Words and letters and there respective values

WORDS/ LETTERS	THUMB	INDEX	MIDDLE	RING	PINKEY	VALUE OF (X,Y,Z) AXIS
HELLO	62	92	89	93	94	(102,448,765)
FINE	59	89	94	49	54	(119,384,668)
NICE	63	65	84	88	91	(114,845,695)
C	87	71	44	36	31	(225,745,841)
L	89	88	35	39	42	(234,741,816)
M	56	87	84	92	54	(745,254,623)
N	56	93	87	48	51	(765,268,630)

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SCOPES OF OUR PROJECT

There are many positive sides of our project which produce the high performance skill and easy to grip of our system. The important sides of our project are-

- Less time delays.
- The response time of our system is very speedy.
- Our system is fully automated.
- This system takes less power to control.
- The cost of the system is very low and flexible to user.

In future, this project can be implemented using wireless systems like Bluetooth, RF module etc. to obtain enhanced handling of the equipment. The number of messages can be increased by increasing the database according to combination of the different hand motion and gestures. Further this system can be implemented by using image processing.

CONCLUSION

The key endeavor of this project is to reduce the communication hurdle between deaf and dumb community and normal people using our system i.e. give the voice output from gesture or sign input. Talking hand speaking system for mute people using Arduino and flex sensors is successfully executed with high performance skill. Due to the performance, the deaf and dumb people can easily communicate with others and they can use this tool as a part of their daily habit.

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