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Gesture Glove

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Abstract: **- Sign language paves a way for mute people to communicate with each other. However, it is only possible for those who have undergone the special training to understand the language. Speech impaired people need to communicate with normal people on a daily basis. To bridge this communication gap, our project aims to develop a system for recognizing the sign language. Sign language uses intricate hand gestures to convey various words and phrases. Our system translates these finger spelling (signs) into voice in real-time, using flex-sensor based gesture gloves. Gesture data from the sensors on gloves is sent to the processing unit. Classification algorithms are used to match the sensor input to the pre-defined gesture to identify the word. Every sign gesture varies in time and space. Also, signing speed and position differs for every person. The goal is to compensate this variation in speed and position by training a set of gesture samples for every sign.**

Keywords**: - Sensor, Classification algorithms.**

I. INTRODUCTION

Worldwide, at least 360 million people are likely to be deaf and dumb (or simply deaf). In order to communicate with other people, these people use sign language. A sign language consists of a set of manual gestures that use fingers, palms, arms, and even body movements to represent letters, numbers, and words. However, most of the non disabled people do not know this type of language. Therefore, for mute people performing daily activities turns out to be hard, especially in public areas. Also, it is not feasible to carry a translator all the time. Additionally, it is difficult and expensive to make non-disabled people learn sign language. For these reasons, automatic systems that translate sign language into speech are required. Sign language uses manual communication and the body language to convey the intended message unlike acoustically conveyed sound patterns. Communication between the deaf and the mute with the normal people is a greater challenge than communication between the blind with the normal people. When the deaf or the mute communicate with the normal people, they often encounter couple of major problems. First of all, there is no universal standard in the sign language. Each country possesses its own sign language. Secondly, the person who has no knowledge of the sign language will not be able to understand the message being conveyed by the deaf or the mute. In some cases, misinterpretation of the signing gesture may also cause problems. Hence, it can be concluded that there exists a barrier in the communication using sign language. To remove this barrier, the sign language interpreter device is used. American Sign Language (ASL) is chosen for interpretation as it is the most widely used sign language across the world. Like any spoken language, ASL is a language with its own unique rules of grammar and syntax. ASL is used predominantly in the United States and in many parts of Canada. It is accepted by many high schools, colleges, and universities in fulfillment of modern and "foreign" language academic degree requirements. The letters of English alphabet in American Sign Language is as shown in figure 1.

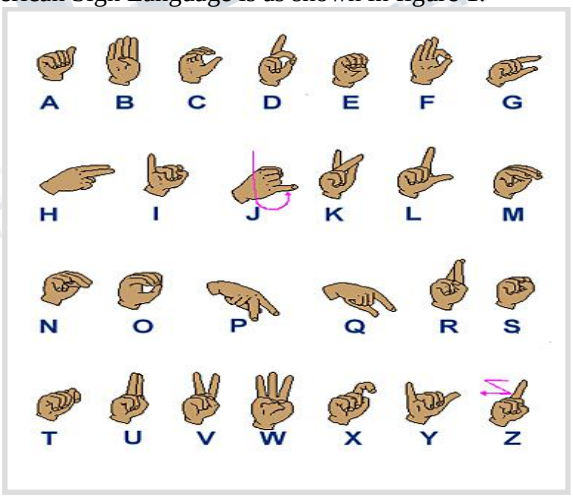

Figure1.The letters of the English alphabet in ASL

II. LITERATURESURVEY

Gesture is nothing but movement of hands, face and other part of body which is used to communicate specific message to express thoughts, ideas, emotions, etc. In the field of Human-Computer Interaction (HCI) hand gesture recognition is an active area of research. Gestures find its application in GUI and mobile workstation, virtual reality and gaming, controlling drone and vehicles, controlling robotic arm etc. Gestures in the form of sign language have

been used by deaf and dumb people throughout history. One of the earliest written records of a sign language is from the fifth century BC, in Plato's Cratylu. In 1680, George Dalgarno published Didascalocophus, in which he presented his own method of deaf education. He suggested that the manual alphabet could also be used by mutes, for silence and secrecy, or purely for entertainment. However, it is only possible for those who have undergone the special training to understand the language. Speech impaired people need to communicate with normal people on a daily basis. To bridge this communication gap, gesture gloves or vision based system are being developed for recognizing the sign language.

1. Comparative Study of Hand Gesture Recognition System Rafiqul Zaman Khan1 and Noor Adnan Ibraheem2 International Journal of Research in Computer and Communication technology.
This paper describes techniques for hand gesture recognition- Data-Glove based and Vision Based approaches. The Data-Glove based methods use sensor devices for digitizing hand. Due to extra sensors it is easy to collect hand configuration and movement. The other approach is the Vision Based methods which require only a camera, thus it gives a natural interaction between humans and computers without the use of any extra devices. Our choice of data gloves was because of the portability it offers, better performance as raw data is directly feed into the processor and more freedom of movement for hand gestures [13].
2. Sign Language ConvertorTaner Arsan and Oğuz Ülgen International Journal of Computer Science & Engineering Survey (IJCSES) Vol.6, No.4, August 2015.

This paper summaries various approaches for recognition of sign language - Template Based Approaches, Knowledge Based Approaches, Statistical Based Approaches, Learning Based Approaches and The Artificial Intelligence Approach. We focus on modeling statistically, using automatic, statistical learning procedure, typically the Hidden Markov Models, or HMM. Other technique of implementing the project is using Neural network approach in which we aim to use Supervised learning approach to predict the output for known set of outcomes.

3. How hand gestures are recognized using a data gloveMario Ganzeboom. In this paper how gestures can be recognized when using the data glove as means of input is researched. Gestures for basic interface tasks like clicking, dragging, zooming and rotating are defined. After having found a suitable HMM library, its algorithms are used to train and tune a HMM on a set of observation sequences. Eventually gestures are recognized with two HMMs parallelly connected [12].

4. Gesture Classification Using Hidden Markov Models and Viterbi Path Counting. Nianjun Liu, Brian C. Lovell Proc. VIIth Digital Image Computing: Techniques and Applications, Sun C., Talbot H., Ourselin S. and Adriaansen T. (Eds.), 10-12 Dec. 2003, Sydney
This paper describes a Hidden Markov Model (HMM) based framework for hand gesture detection and recognition. Once when the values from the sensors are given to the processor for identifying the gesture we need to use Hidden Markov Model. The model and observation sequences are used to calculate the most likely sequence of state that produces it. This approach can be used to recognize words from gesture input data.
5. An Accelerometer-Based Gesture Recognition Algorithm and its Application for 3D InteractionJianfeng Liu1, Zhigeng Pan1, and Xiangcheng Li2
This paper describes the use of accelerometer based glove for application in virtual environment. The data is fed to the PC via a wireless protocol and semantic models are developed for recognition of gesture and mapping it to the virtual world. The paper presents a comprehensive detail on integration of sensors in gloves and wirelessly data transfer to the processing unit [11].

6. Gesture Recognition Using Data Glove: An Extreme Learning Machine Method Danling Lu, Yuanlong Yu, and Huaping Liu Proceedings of the 2016 IEEE International Conference on Robotics and Biomimetics Qingdao, China, December 3-7, 2016
In this paper, a novel data glove called YoBu is used to collect data for gesture recognition. Extreme learning machine (ELM) is used for gesture recognition. Data of static gestures is collected as well as a gesture dataset is established. In addition, features plays an important role in classification are analyzed. The papers provide details on methodology to extract different features from gesture data and search its corresponding meaning from the dataset [14].

7. Glove-Talk: a neural network interface between data glove and speech synthesizer. S. Sidney feks.IEEE International Conference on Neural networks.
The paper demonstrates that neural networks can be used to develop the complex mappings required in a high bandwidth interface that adapts to the individual user. With a Gesture-to-word vocabulary, the wrong word is produced less than 1% of the time, and no word is produced about 5% of the time. The paper provides a model to categorize the gesture using input-output function of neural network model [12].

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III. PROPOSED SYSTEM

Speech impaired people need to communicate with normal people on a daily basis. However, it is only possible for those who have undergone the special training to understand the language. To bridge this communication gap, we are developing gesture gloves for recognizing sign language. Our system captures the hand movements using customized gesture glove with flex sensors and accelerometer. The Hand movements are measured in terms of bend of each finger and orientation of hand. The data from the sensors is sent to the computer through wireless interface using Bluetooth module. Our software approach incorporates the use of feed forward neural networks to classify gestures into corresponding word. The user interface will play the audio and display the text of the recognised word. Gestures performed by multiple users will be tested for all the letters in American Sign Language.

MODULE 1 - GESTURE CAPTURE

The flex sensor and accelerometer is interfaced with the digital ports of Arduino microcontroller. The Flex sensors measure the bend of each finger and the accelerometer measures the orientation of hand in various axis. Arduino microcontroller processes the data from the sensor and forwards it wirelessly to the computer via Bluetooth module. These sensors reading from 10 flex-sensors and 6 accelerometer(x, y and z axis) are input to neural network model.

MODULE 2 - GESTURE RECOGNITION

Our approach is to incorporate classification methods to recognize various gestures. We aim to use supervised learning approach to predict the output for known set of outcomes. We choose to map the a complete hand gesture to a whole word using feed forward neural network. The neural network model provides an adaptive interface for gesture inputs from various users varying in orientation and speed. The system will be trained with different gesture inputs to accurately classify the performed word.

MODULE 3 - USER INTERFACE

On recognition of gesture, an audio file corresponding to the recognized gesture will be fetched from a pre-stored database for playing. Various searching algorithms are incorporated to optimize the search. The text form of the corresponding word is also displayed on the user interface.

IV. HARDWARE AND SOFTWARE REQUIREMENTS

For developing the proposed system, the hardware and software platforms to be used are as mentioned below:

1. Hardware:

1. Flex Sensors 4.5”
2. Accelerometer (ADXL 335)
3. Bluetooth Module (HC05)
4. Lithium Battery Lipo 9V
5. Wires
6. PCB Circuit board
7. Gloves
8. Arduino microcontroller (NANO)

2. Software:

1. Arduino IDE for Embedded Programming.

DESIGN

This section describes the diagrams which define the complete flow of modules as described in the proposed system.

1. Block Diagram

The proposed system uses a sensor gloves to capture hand movements. The data is sent to the computer for recognition of gesture. The block diagram of the system is as shown in figure2.

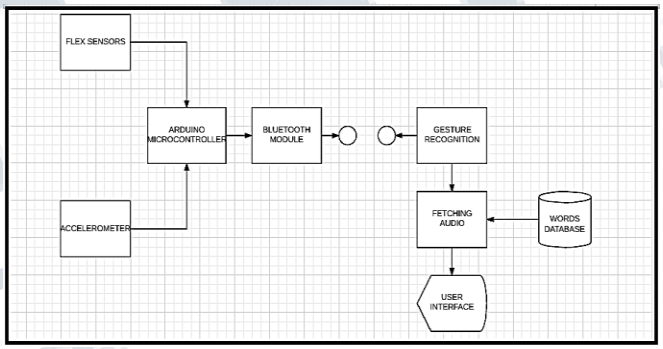

Figure.2 Block Diagram of Sign language to speech conversion

The Flex sensors measure the bend of each finger and the accelerometer measures the orientation of hand in various axis. The 16 input reading - 10 from flex sensor and 6 from accelerometer(x, y and z axis) are feed to the arduino microcontroller which transfers it wirelessly to the processing unit via Bluetooth module. The translation of hand gesture to word is a two step process. The first stage involves decoding of gesture. The 16 input data is feed to the multi-classification feed forward neural network. The network model calculates probability across each output class. On recognition of class, the corresponding decoded word is searched from the word database to fetch the speech of word. The recognized word in text format is displayed on the user interface on the computer.

2. Activity Diagram

The user will first wear the gloves and launch the application. The system will initially be in off state. On getting ON the application search for any device. If the

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device is found then gesture gloves is connected to application for data transfer. The sensors measure the gesture values. Next input data is transferred to the application. The application processes the hand movements and recognizes the word. The word is displaced as text or audio. Then user performs next gestures. If the user doesn't want to perform new gesture, the application is closed.

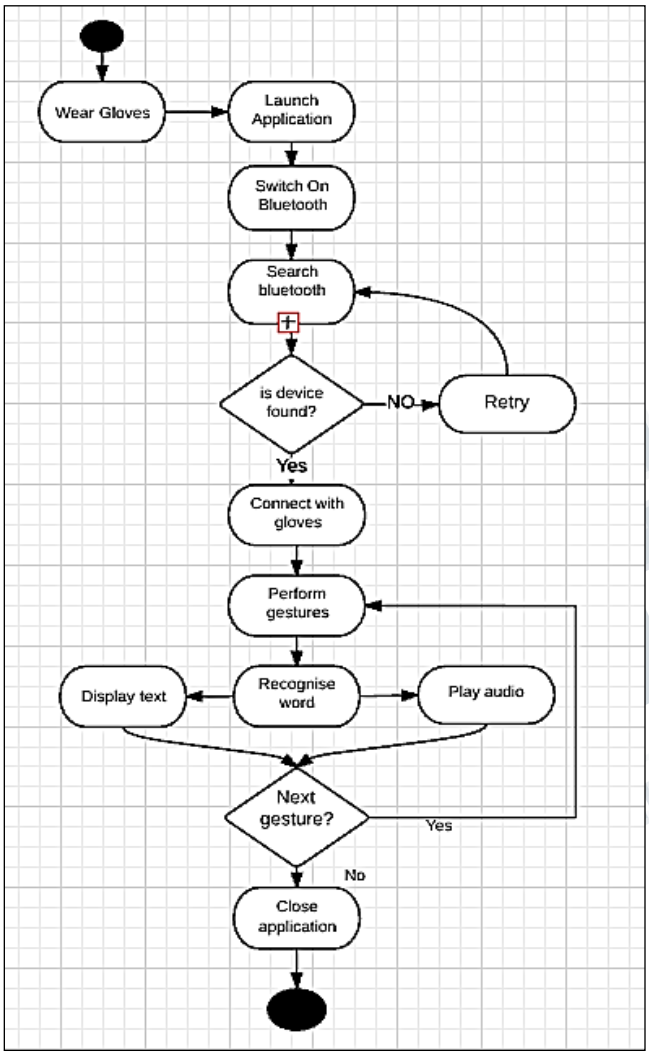

Figure.3 Schematic Diagram of gesture glove

2. PCB Design

A 9v dc battery supply is provided to the complete circuit but as we require only 5v dc supply the 9v dc battery supply is step down to 5v dc supply.. The Arduino NANO is used for processing part on the glove. It has total 30 pins. The flex sensors are connected to the PCB along with 10k ohm registers for each sensor to collect the values from it. The accelerometer which is present on hand is also connected to PCB. A 5v dc supply is provided All to it and all the 3 axis values are connected to PCB from where the output values will be taken. All the 8 analog values (5 flex sensors and 3 from Accelerometer) are connected to AD0 - AD7 pins of Arduino NANO which will send the values via Bluetooth module to the processing unit. Now in case of Bluetooth Module we require 3.3 v dc supply which we can get from Arduino NANO directly by connecting the VCC pin of it to 3.3v dc supply pin of Arduino NANO and the TXD and RXD pin of the Bluetooth module are connected to TXD and RXD pins of Arduino NANO to perform all the transmission of data. Figure 3 and 4 below show the schematic diagram and circuit diagram for sign language to speech conversion.

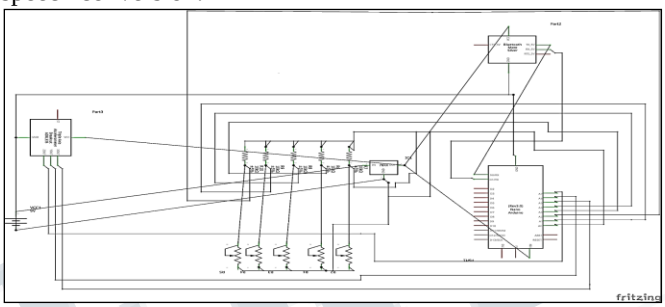

Figure.4 Schematic Diagram of gesture glove

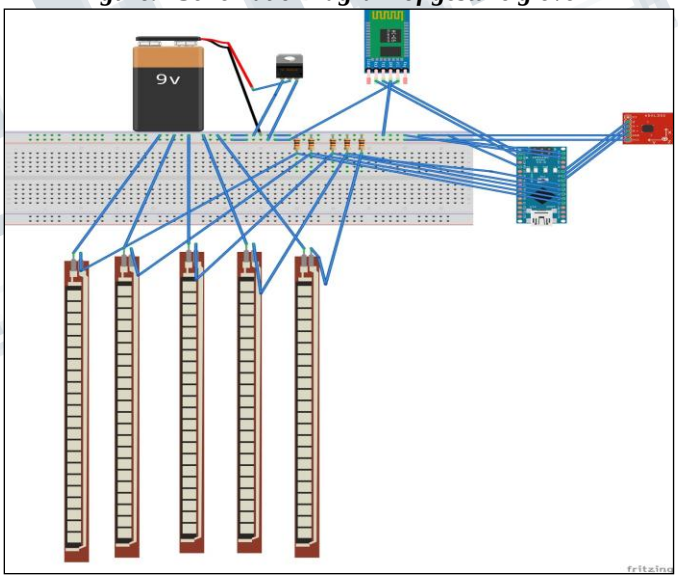

Figure.5 Circuit diagram for gesture glove

V. IMPLEMENTATION

This project is mainly concerned with letting the non-disabled people know what the disabled people are trying to say with their sign language. This can be done with the help of the system where we capture the hand gestures values and performing processing to play the appropriate audio of the gesture. Figure 5 shows the implementation diagram for sign language to speech conversion using gesture glove.

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Levels of Implementation

1. Level 1: In order to communicate with the non-disabled people, the disabled people need to use sign language. The disabled people need to wear the glove and then perform all the hand gestures (sign language) on which the hardware unit will be placed. The hardware unit of our project includes the flex sensors, accelerometer, arduino and Bluetooth modules which will collect all the gesture values and pass it wirelessly to the processing part.
2. Level 2: In order to play the audio of the performed gesture we will process the data value which has been transmitted wirelessly via the Bluetooth module to the processing part. The data which we get is processed using our algorithms and then the files are predicted, and a appropriate file is fetch for the particular gesture and further that audio file is played and also the same gesture is displayed in text format on screen.

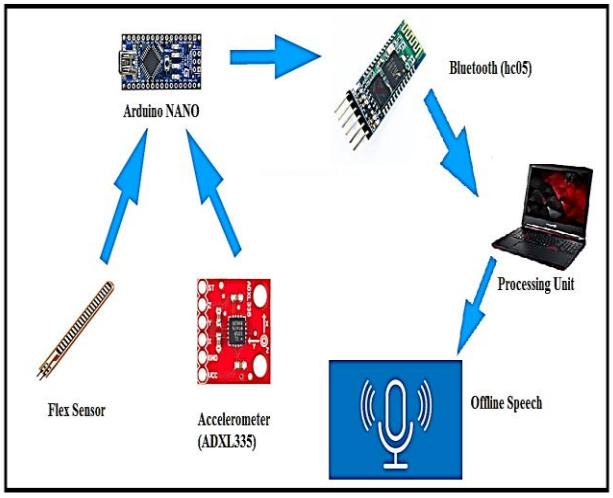

Figure.6 Implementation Diagram of Sign Language to Speech Conversion

VI. CONCLUSION

The system we are planning to develop will bridge the gap between mute people and common man. The Sign language used by mute people is not understood by all. Our idea is to capture this sign language performed via hand gesture and translate it into appropriate word or phrases. The first level of implementation is focused on development of gesture gloves that includes flex sensors and accelerometer that measures the hand movements. The second level of implementation is focused on development of application that maps the hand movement into appropriate word. This software approach is divided into training and testing phase. Training encompasses of recording the gesture sequence for every word. This sequence is validated with actual hand gestures by a signer during testing phase. The third level of implementation will include development of user interface to play the audio file of word and display the text.

REFERENCE

[1] Https://www.arduino.cc/en/Guide/ArduinoNano

[2] Http://ieeexplore.ieee.org/document/7118418/

[3] Http://ieeexplore.ieee.org/document/7569545/

[4] Http://www.lifeprint.com/

[5] Http://ieeexplore.ieee.org/document/7380825/

[6] H.Ushiyama, K.Hirota, and K.Murakami, "Hand Gesture Interpretation using Neural Networks," 40th Information Processing Conference Proceedings ,VO1.4, 1990, pp,152

[7] Https://www.arduino.cc/en/Tutorial/HomePage

[8] Glove-Talk : a neural network interface between data glove and speech synthesizer. S. Sidney feks.IEEE International Conference on Neural networks

[9] Comparative study of hand gesture recognition system Rafiqul Zaman Khan1 and Noor Adnan Ibraheem2 International Journal of Research in Computer and Communication Technology

[10] Gesture Recognition Using Data Glove: An Extreme Learning Machine Method Danling Lu, Yuanlong Yu, and Huaping Liu Proceedings of the 2016 IEEE International Conference on Robotics and Biomimetics Qingdao, China, December 3-7, 2016