A new data glove approach of hand sign recognition based communication system for speech impaired person

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Abstract : The people who unable to speak and hear are called speech and hearing impaired people. These people face a lot of problems while live in the world. The main problem comes about the communication. Because language they are used to communicate is a sign language which is difficult to understand by normal people without knowledge. The main goal of this project is to make the reliable communication between normal and speech impaired people. To achieve this goal, specially designed data glove is required which consist of flex sensors, 3-axis accelerometer. Here, Template matching algorithm is used to handle and process the sensor data. By using this sensors, system grown up with the real-time communication by the simple way.

IndexTerms **- Sign language, Gesture recognition, Flex Sensor, Data glove, Template matching, Vision and Glove based Systems.**

I. INTRODUCTION

In the survey of Indian Census 2011 it's observed that over 26 million people having some kind of disability that is equivalent to 2.1% of the total population. There are various kind of disability that is hearing impairment (19.5%), disability in movement (that accounts to 20.9%), and speech impairment (7.68%). People with speech disability use sign language to communicate with the other people in the society. The regular idea for gesture recognition is by using camera based system to track the hand gestures. The camera based system is not so much friendly as compared with the other systems available in market and it would be difficult to carry. In addition, camera based system would pick up multiple unwanted gestures from different people who are in its viewing angle. So it's not possible to use it in crowded area. Separation of such unwanted gestures is complex and not a fair solution. The sign language varies from region to region also varies within a countries.

The previous systems has some limitation, however the system was broadened as the concept was modified to be more flexible with the addition of features. The concept of glove based system and it's advancement is discussed in this paper. The glove is used to recognize the hand sign and convert it to text and speech which can be played out through the Android mobile application.

II. SIGN LANGUAGE

Sign language is the language which used to convey idea or thinks. Sign language is a way to communicate by using the hand gestures, expression of the face, and using other body parts. These hand gesture are sometimes used to express the ideas. By using sign language we can make communication between people without any acoustic sound. It based on sign patterns like position and movements of the arm that make communication between individuals. In the sign language gesture is defined by the body part movement, mostly hand and face, to deliver an idea or meaning. A sign language consist different signs which has different meaning. Some examples of the sign language is as follows:

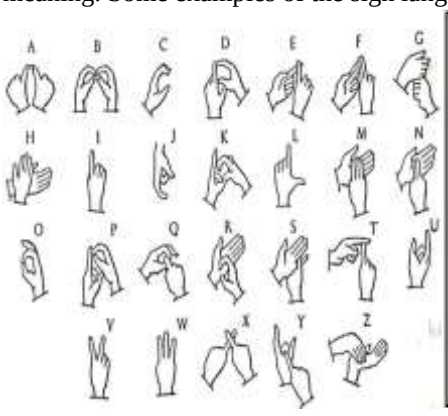

Fig 1: Indian Sign Language[6].

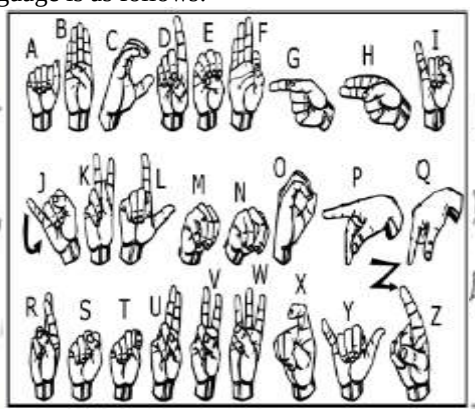

Fig 2: American Sign Language[5].

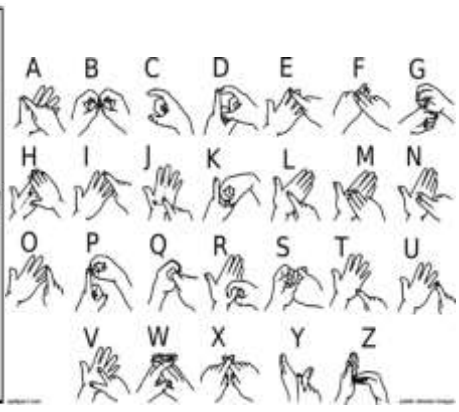

Fig 3: British Sign Language[7].

III. OVERVIEW OF RESEARCH

Data glove is one of the important part of this research. In market, various types of data gloves available but generally they were designed to use of gaming and other applications. But till now no any system available which can convert sign language into text .However, a lot of research has been done to develop some portable, highly accurate and efficient system which can make some help to speech impaird people. There are two types of system available based on different approaches:

In case of vision-based systems, camera is used as input to the system and we has to work on digital signal which is not an easy task. It also demands lengthy and vast programming. So the system performance is quite slow.

In case of glove-based systems, a lot of the hardware is required. We have required to connect large number of cables to the computer. So the system takes larger space to operate. In case of our system, flex sensors that we are using are easily available in market. Also, the Arduino microcontroller used by us is very compact and smaller in size. So the system is handy enough to use.

IV. ACTUAL SYSTEM

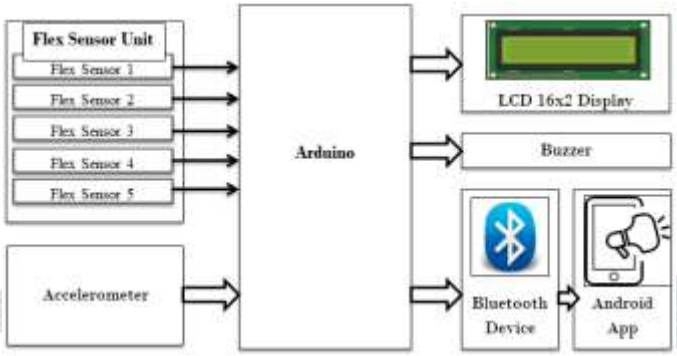

Fig.4 Proposed system Block Diagram.

The proposed system consists of Arduino Nano microcontroller, five flex sensors, 3 axis accelerometer, Bluetooth module, 16*2 LCD display, buzzer and an android mobile phone.

Firstly, microcontroller gets the sensor values from the flex sensor and 3-axis accelerometer. According to this sensor values, templates created for each and every different sign. To the purpose of making a template, Template Matching Algorithm is used. Template matching algorithm consists of following steps:

i. Calibration of Gloves
ii. Creation of libraries
iii. Storage of multiple templates for each gesture in a database.

The following flow chart depicts the functioning of our project.

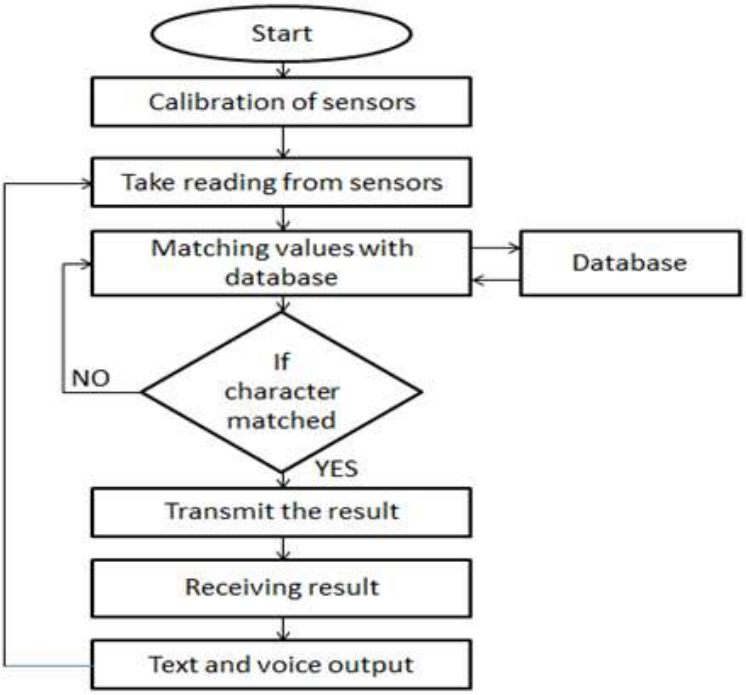

Fig.5 Flow of Proposed System

When the user makes some sign, we will obtain some range of sensor values. If these sensor values matched with the template database then controller understand that it is a valid gesture. Further, controller sends the meaning of that gesture to the LCD display and Android mobile in the form of text. Android mobile app will convert this text into voice.

V. EXPERIMENTAL SETUP AND RESULTS

In the experimental setup as shown in fig.6, Data glove consists flex sensors, voltage divider circuit and 3-axis accelerometer. The resistance of 10K is also used to make voltage divider circuit. MCU unit consists Arduino Nano microcontroller, Bluetooth Module and 16*2 LCD Display.

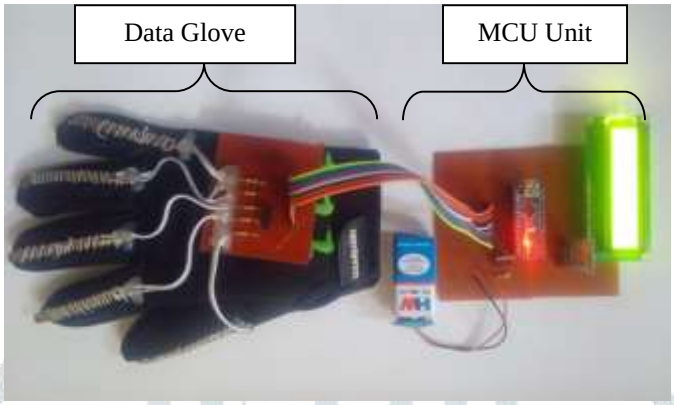

Fig.6 Experimental Setup.

To connect experimental setup to the Android Application, we have to follow three steps as shown in fig.7. Firstly we have to open specially developed Android Application in our mobile. After that we can select Bluetooth paired devices from which you want to receive a data. Finally our setup will connect to the Android Mobile.

Fig.7 Experimental Setup connected to the Android Mobile Application via Bluetooth.

RESULT 1

In the experimental results shown in fig.8, fig9. The different hand sign are given for each alphabet in the result 1. In the fig.8 we can see the gesture sign for Y, O and U alphabet. The result for this hand signs are shown in fig.9

Fig.8 Different gesture sign for each alphabet.

Fig.9 Result of gesture sign made by user.

RESULT 2

The result 2 shows a whole sentence instead of alphabet is defined by the one hand gesture sign. That's mean we can make either character by character communication or sentence by sentence communication. The user wants to say "HELLO WORLD" so he made a gesture shown in left hand side of the fig.10 which is defined in the database and right side indicates word meaning for that particular sign displayed on the Android mobile screen.

Fig.10 Gesture Sign and Result to say Hello World.

RESULT 3

Similarly, In third result we can see that as user make a particular gesture sign(left side in fig.11) to say "How are you?", then after processing the data through the system it displays meaning of that gesture on the Android Application. The meaning of the hand gesture is previously stored in the database.

Fig.11 Gesture Sign and Result to say How are you?

CONCLUSION

This paper gives a brief information about the project that is useful for speech and hear impaired. This work solve the purpose quite well This project is nothing but a prototype to check the feasibility of recognizing sign languages using flex sensors. After making this prototype we can say that data gloves with no of sensors can be used to recognizing sign language. More sensors can be employed to make the system more accurate.

REFERENCES

[1] Priyanka Lokhande, Riya Prajapati, Sandeep Pansare, "Data gloves for sign language recognition system," National Conference on Emerging Trends in Advanced Communication Technologies (NCETACT) 2015 pp 11-14.

[2] Ajinkya Raut, Vineeta Singh, Vikrant Rajput, Ruchika Mahale, "Hand sign interpreter" The International Journal of Engineering And Science (IJES) Vol. 1 pp.19-25 2012.

[3] Vishal Pathak, Sushant Mongia, Gaurav Chitranshe, "Framework for hand gesture recognition based on a fusion of flex, contact and accelerometer sensor," Third International Conference on Image Information Processing pp. 312-319, December 21 - 24, 2015.

[4] Wang Jingqiu, Zhang Ting, "An arm-based embedded gesture recognition system using a data glove," 26th Chinese Control and Decision Conference (CCDC), pp 1580-1584, 2014.

[5]https://www.google.co.in/search?q=american+sign+language&rlz=1C1SQJL_enIN792IN792&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiP7cu60ejaAhXLKo8KHSbQBRkQ_AUICigB&biw=1366&bih=662#imgrc=ROeundnMRM52eM:

[6]https://www.google.co.in/search?q=indian+sign+language&rlz=1C1SQJL_enIN792IN792&source=lnms&tbm=isch&sa=X&ved=0ahUKEwib6qaG0ujaAhXLrY8KHcgWB8AQ_AUICigB&biw=1366&bih=662#imgrc=rXfLZoqz1Co5iM:

[7]https://www.google.co.in/search?q=british+sign+language&rlz=1C1SQJL_enIN792IN792&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiGstmi0ujaAhULp48KHWSjCtMQ_AUICigB&biw=1366&bih=662#imgrc=ZabFpdcO2SyvIM: