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Wearable Tech Gloves for Speech Impaired People

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***Abstract*—Wearable Tech Gloves aims to facilitate speech impaired people by means of glove based communication interpreter system. The glove is equipped with four flex sensors. For each specific gesture, the flex sensor produces a proportional change in resistance. The processing of these hand gestures is in Arduino Uno board which is an advance version of the microcontroller. It compares the input signal with predefined voltage levels stored in the memory. According to that outputs will be translated text and audio in Indian Language. In such a way it is easy for speech impaired people to communicate with normal people.**

***Index Terms*— Flex sensor, Arduino Uno, Accelerometer, Bluetooth module.**

I. INTRODUCTION

According to the statistics of the World Federation of the Deaf and the World Health Organization, approximately 70 million people in the world are deaf–mute. The majority of speech- and hearingimpaired people cannot read or write in regular languages. Sign language (SL) is the native language used by the deaf and mute to communicate with others.

SL relies primarily on gestures rather than voice to convey meaning and it combines the use of finger shapes, hand movements, and facial expressions .This language has the following main defects: a lot of hand movements, a limited vocabulary, and learning difficulties. Furthermore, SL is unfamiliar to those who are not deaf and mute, and disabled people face serious difficulties in communicating with able individuals. This communication barrier adversely affects the lives and social relationships of deaf people .Thus, dumb people need to use a translator device to communicate with able individuals. This can be achieved by developing a glove equipped with flex sensors, to measure the flexion of the fingers, Accelerometer, Bluetooth module, Arduino Uno.

The attempts which are made to form the smart glove some of them are less convenient and some of the system outputs had a limited number of text commands and limited words were produced in the voice module related to the gestures made by the speech impaired people. The problem statement for this work may be defined as "To develop a cost effective microcontroller based glove that will allow sign to speech conversion using a mobile phone."

Smart gloves will eliminate barrier between two different communities. With the help of these gloves a speech disabled can also get chance to grow in their respective career. This uses the least possible number of sensors without affecting the system efficiency.

II. LITERATURE SURVEY

"Sign Language Recognition Application Systems for Deaf-Mute People: A Review Based on Input Process

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Output" [1] paper is about the device used in getting the data, data acquisition, such as data from early researches or self-made data, the recognition method that are recently used by researchers, and the output of previous researches. Sign Language Recognition Application Systems is developed in two steps, data acquisition and classification. The Microsoft Kinect is the other popular method used by researchers to acquire their data.. The advantage is that it provides all the data needed more accurately as it also provides fingers movement data. The disadvantages are that they are costly and are difficult to be used commercially the first hand oration mitten was constructed by Ryan Patterson in the year 2001. This model had constraints that a PC or a workstation was constantly required for its working which made it less convenient and less portable. Numerous sophisticated devices have been proposed and developed with different data acquisition methods. These include a Web Camera, Microsoft Kinect device, cameras, 3-axis accelerometer and flex sensors, and a leap motion controller.

"Electronic speaking system for speech impaired people: Speak up," [2] project is an electronic speaking system was developed to ease the communication process of speech impaired people. A glove was developed which consists of five flex sensors. When a gesture is made with the glove, the change in resistance of flex sensors fed into the Arduino Nano and specific prerecorded audio command for that gesture is played from SD card through speaker and the text command for that gesture is displayed on the LCD. There are four gestures that are designed for user input so that user can play his/her chosen audio commands using those gestures. This device not only helps a speech impaired person to communicate with a normal person via audio commands but also helps him/her to communicate with a hearing impaired person by displaying the text commands on the LCD.But the system has a limited number of text commands related to gestures

“Smart Glove for Hearing-Impaired” [3] paper, proposed glove is a robotic gadget that interprets American Sign Language Standard into text or speech in order to evacuate the information transmission gap between the mute and the ordinary public. This glove has been actualized with the assistance of flex sensors, accelerometer, microcontroller (Arduino Nano) and the Bluetooth chip. But the system has 7 to 8 number of text commands related to gestures.

"A remote conversation support system for deaf-mute persons based on bimanual gestures recognition using finger worn devices” [4] paper, presents a hand gesture recognition system using Magic Ring (a ring-shape wearable device) instead of data glove or camera to translate the predefined hand gestures into Japanese and to accomplish remote transmission of the information/command between user groups. The hand gestures are defined based on simplified Japanese sign language.

The KNN (K-Nearest Neighbors Algorithm) method is adapted to the pattern recognition according to the bimanual sensing data. To improve the recognition rate, three most similar pre-reserved gestures and similarity are recorded, and Euclidean distance of feature values is used to estimate the gesture similarity. The system shows good usability and most of the users would like to use such a system. Experimental tests showed 77.4 % for right-hand use only. However, system accuracy was low for using only one hand.

Mohandes M, Aliyu S and Deriche M [5] proposed a new approach for Arabic Sign Language Recognition (ArSLR) which involves the use of two Leap Motion Controllers (LMC) to prevent the case of one finger being occluded by another finger or hand. This device detects and tracks the hand and fingers to provide position and motion information. They proposed to use the two LMCs as a backbone of the ArSLR system. In addition to data acquisition, the system includes a preprocessing stage, a feature extraction stage, and a classification stage.

Fusion of evidences from the two LMCs at the feature extraction and classification stage was also investigated using Dempster-Shafer theory of evidence. Features fusion from the two LMCs gives 97.7% classification accuracy with Linear Discriminant Analysis (LDA) classifier and 97.1% with classifier level fusion. This gives better recognition over the use of a single LMC.

III. METHODOLOGY

The flow of algorithmic program employed in the system is as shown in below figure.

The overall functioning of the System is explained through the diagram shown in below figure. It represents the operating blocks of the proposed system.

To communicate, speech impaired people uses the sign language. When the hand gestures are made by the user, the gestures are identified by the sensors. To communicate, speech impaired people uses the sign language. When the hand gestures are made by the user, the gestures are identified by the sensors.

The Digital output is then compared with the preloaded values of device within the system for the alphabets, if the digital output matches the preloaded values then the compared output is given as a text output on the mobile screen which can facilitate a standard person to browse and perceive.

An equivalent output is transmitted over a Bluetooth module and so via Bluetooth link output is distributed to mechanical man Smartphone that is connected to the Bluetooth module and consisting of Text to Speech (TTS) conversion application.
The serial input is received via the Bluetooth link on the connected device and a text output is received on the appliance with speech output from the speakers.

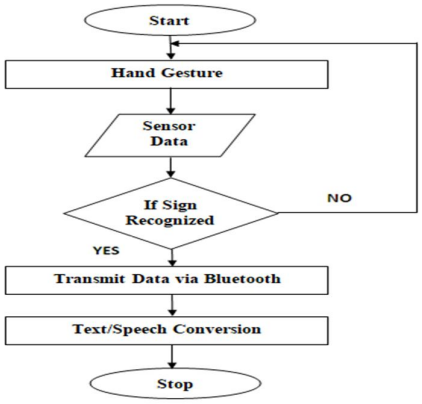

Fig 1: Flow chart of the proposed system

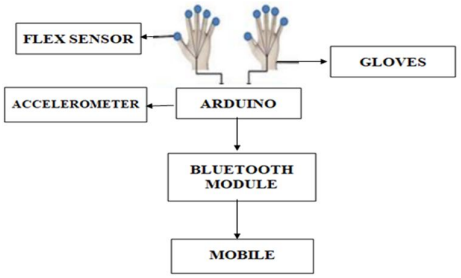

Fig 2: A block diagram of proposed system

A. Flex Sensor

Flex sensor means flexible sensors which change resistance based upon the curve made by fingers on the sensor. So the resistance is directly proportional to the bend made.

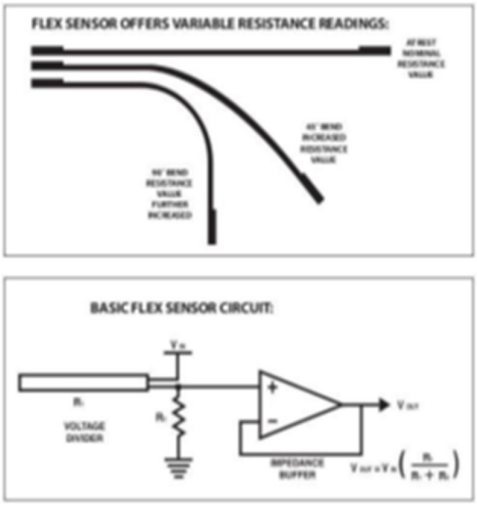

Fig 3: Flex Sensor

Flex sensor are made up of carbon resistive element within a thin bendable substrate. When the substrate is angled the resistive element gives a resistive output relative to the curve radius. The system consists of 4 flex sensors which are stitched on the fingers of the gloves because the main part of the gestures are fingers so for each finger a separate sensor is required. The hand gesture is inputted to the system via flex sensors the bent of each finger. As the fingers bends the sensors also starts bending and as the sensors bends the resistances also changes accordingly and that resistance value is inputted to the Arduino Uno.

B. Accelerometer

The MPU 6050 is shown below.

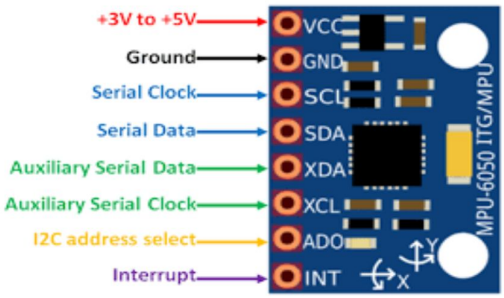

Fig 4: Accelerometer

The MPU6050 has both a gyroscope and an accelerometer, using which we can measure rotation along all three axes, static acceleration due to gravity, as well as motion, shock, or dynamic acceleration due to vibration.

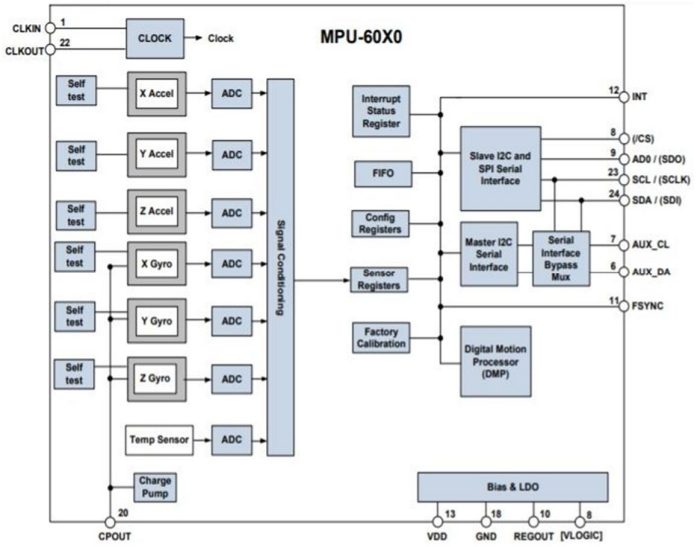

Fig 5: Block Diagram of MPU 6050

MPU6050 consists of a 16-bit analog to digital converter hardware. Due to this feature, it captures three-dimension motion at the same time. This module uses the I2C module for interfacing with Arduino.The accelerometer is placed on the wrist to sense the bending motion.

C. The Bluetooth module HC-05

The Bluetooth module is used to carry content from Arduino to mobile shown in below figure, this module sends serial data to the target device and the target device displays that data on the screen.

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. The Bluetooth Module used in this is HC- 05.

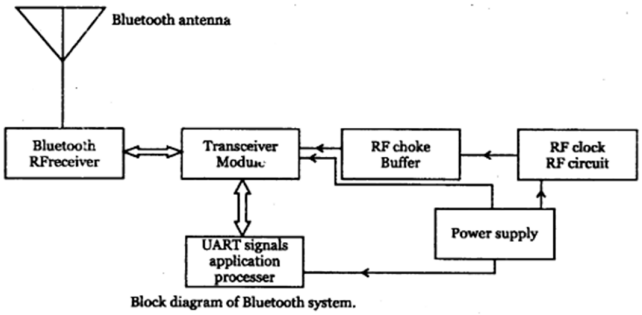

Fig 6: Block Diagram of Bluetooth System

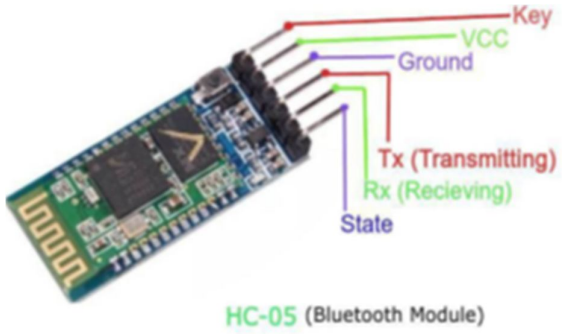

Fig 7: Bluetooth Module HC-05

IV. Conclusion

Sign language is a method used for communication by speech impaired person. Here we are converting sign language into text and speech, utilizing data gloves communication barrier between two different communities is eliminated. Using data gloves speech impaired person can also grow in their carrier and makes nation grow as percentage of disabled person is millions in count. The system may be a bridge between traditional and dumb or speech impaired people it fills the gaps of communication between dumb or speech impaired people and traditional people. This system requires fewer components so its cost is low. Due to small size we can place its hardware on our hand easily and it's also light weight. Therefore it is flexible to users and easy to operate.

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