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An Automated Sign to Speech Portable Translator for Vocally Challenged using Android and Touch Sensors

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ABSTRACT

The only medium of communication for speech impediments is through sign language and most normal peoples aren't aware of this sign gesture which makes it difficult for them to communicate. To address this issue a low cost sign to speech translating system is presented. With the help of various sensors (flex sensors, contact sensors, accelerometer etc.) we aim to collect information through users hand gestures and convey them through actuators (speaker, display screen etc.). Depending upon the hand gesture and the pattern of fingers sensors installed on gloves will provide a reading by detecting varying resistance of flex sensors. Apart from this device, the system also includes an android application which will receive the signals from the device and by using androids built-in text-to-speech and speaker. The main feature of the device is it's two modes of operations, the learning mode and action mode, for assisting fresh trainee of sign language the learning mode is provided with to store manual sign and output for that sign apart from the traditional sign language and action mode is the actual working of device to speak out the sign.

KEYWORDS

Sign Language, Sign to Speech, Speaking disability, Flex sensor, Contact Sensor, Assistive Technology

INTRODUCTION

As stated by WHO (World Health Organization) over 5 million people are suffering from speech impairment in India and over 37 million people across the globe which makes this an important social issue to concern. Our aim is to minimize the barrier between mute peoples and their interactions with normal peoples. The device is equipped with different types of sensors (mainly Flex and Contact sensor) which used the change in resistance [3] and the sense of touch respectively based on which an estimation of hand gesture can be identified and made known with the help of speaker and a display. As the gesture is detected the device will start acting and as the gesture will be checked against a predefined database. The portable word in device name refers to the gloves onto which the whole device is to be installed. As per the early estimation five sensors will be installed within the glove one for each finger. This sensor will be used to detect any gestures made by the hand and the simple - reflex agent approach will be used. This approach chooses actions only based on the current percept. It continuously examines the hand gestures as a state and if there is any change in gesture it will get that gesture to the arduino for the processing. As per the arrangement of sensors, certain readings are placed for each alphabets and words which will acts as an actuator to give outputs to the user. The operating range of Flex sensors are 10Ω when completely stretched and 50Ω when completely flexed. Apart from this an Android application is provided to keep the track on the various hand gesture of user in a database and that will be matched to provide the output. A number of studies have been conducted to improve the mobility of blind and visually impaired people. The device includes two modes of operations, the learning mode and the action mode. In the learning mode the user can create some manual gestures and this gestures can be added to the androids database to make device more ease of use and the other mode i.e. the action mode is the actual mode of working into which the device will match the gestures or patterns and will provide the accurate output.

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LITERATURE REVIEW/ PREVIOUS WORK

Several previous attempt have been made to provide a technological solution for this social issue, a lot of research and patent is being registered over this technology all having their own advantages and disadvantages.

A 3d hand gesture coding for sign language learning is being developed by Yi Ji. This technology focuses on providing a coding based solution for recognition of Chinese sign language. It made use of leap motion device (LMD) which extract the coordinates of the 3d hand gesture and later integrating the device with virtual reality scenes. LMC device tracks hands in camera's field of view and maintains the inner models for them. The longitudinal arches is evaluated as full raised, half raised, clenched (folded) or crossed with neighbour finger [1]. With the help of coordinated and the angle made by the fingers a code is developed for a particular alphabet and this enhance the learning process of sign language.

In another work, Smart Glove for Sign Language Communications was developed by Abhinandan das. In this device various sensors are incorporated onto the gloves and with the help of flex sensor, gyroscope and accelerometer the gesture of hand is recognized and made know to the person communication by sending those gestures signals to an android application with the help ofZigBee module. Much like 3d hand gesture coding for sign language learning, this work also incorporates recognition of user's hand gesture but it also provide to convert this hand gesture in the form of sound signals with the help of an android device. According to their research twenty experiments are conducted and a mean success rate of 86.67% has been achieved.

Hand gesture recognition using Kinect [4] which has sensors to detect both RGB and depth data is Microsoft's Kinect. This system was based on the open NI framework to get the depth data from the Kinect sensor to differentiate the gesture hand from the background. Precisions of up to 99% had been recorded while using this system.

A boosted classifier tree for hand shape detection [5] provides an approach to detect the presence of hands in an image and categorizing the hand shape. The position of hands was determined by using a boosted tree structure cascade of classifiers to recognize the shape in grey scale images. For figuring out the precise shape, the data was clustered into comparable shapes that contained some variation for the classifier to simplify. The AdaBoost and FloatBoost algorithms were used to find group of weak classifiers. Experimentations resulted with a 99.8% success rate for hand detection and a 97.4% success at classification.

PROPOSED SYSTEM

The Indian Sign Language consist of 26 letters of English alphabets and we have tried to implement all this hand gesture recognition to provide accurate result for each of this gesture.

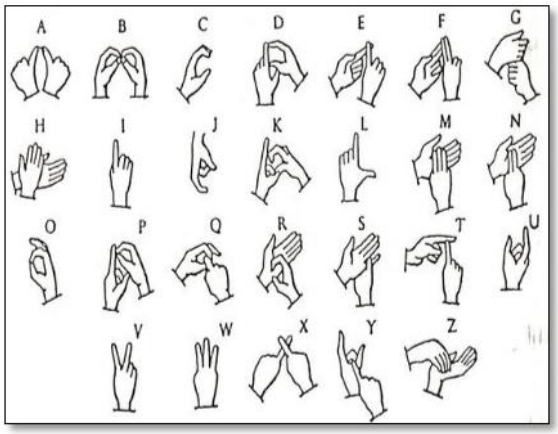

Fig1 : Indian Sign Language

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A. System Overview

A speech impairment person can use our device by wearing the glove installed with circuits. Additionally the app is provided for the user to connect to the device and the output will be provided with that android device.

B. Hardware Settings

Gesture detection is the main tasks of our device for which we will be using a 2.2 flex sensors which changes its resistance when bend. The sensor is connected to a microcontroller. This controller acts as a medium between the sensors and the actuators. The flex sensors sends the signals to the microcontroller and based on the logic provided it gives the output through android device speaker. In our prototype the microcontroller is an Arduino Board, because it was developed to work with sensors and actuator and can easily be accommodated to build small projects.

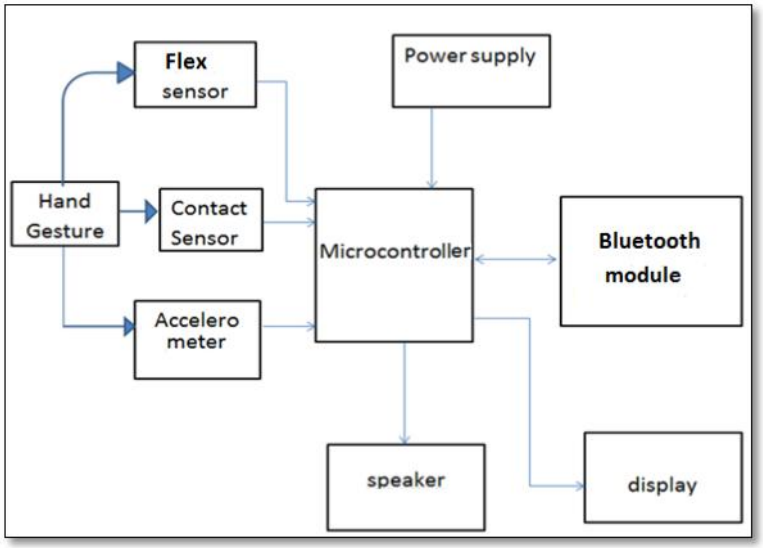

Fig2: Hardware implementation process and internal working

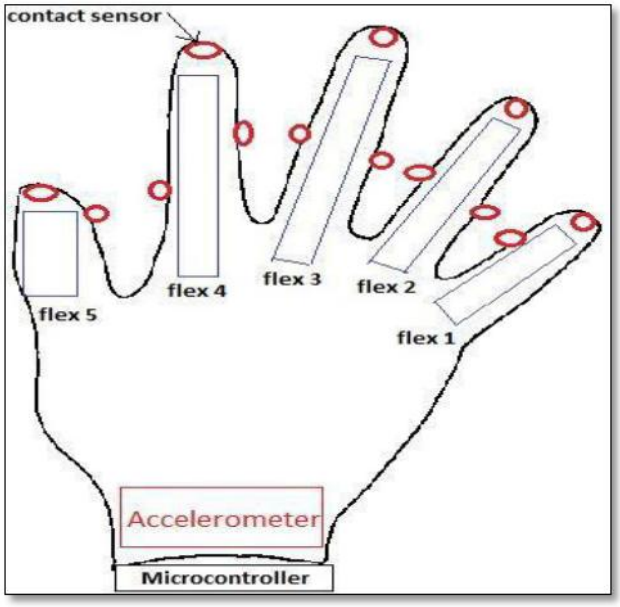

Fig3: Labeling of sensors on the glove

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The flex sensors are fixed for one at each finger and the contact sensors is placed at side of each finger and an accelerometer at the tail end of the device. Each flex sensors is numbered and based on this number when a particular pattern occur it will be detected as a gesture. Let's say to generate an 'L' Shape the flex numbered 4 and 5 need to be completely stretched and the rest of the flex would be completely bend, this will create an 'L' shape and the reading will be recorded. This logic works for the rest of the alphabets as well. Secondly the contact sensor is used to detect the contact between two fingers e.g. for generating the letter 'O' the ends of thumb and index finger need to be touched and that will generate and gesture for letter 'O' here the contact sensor is used to sense the touch.

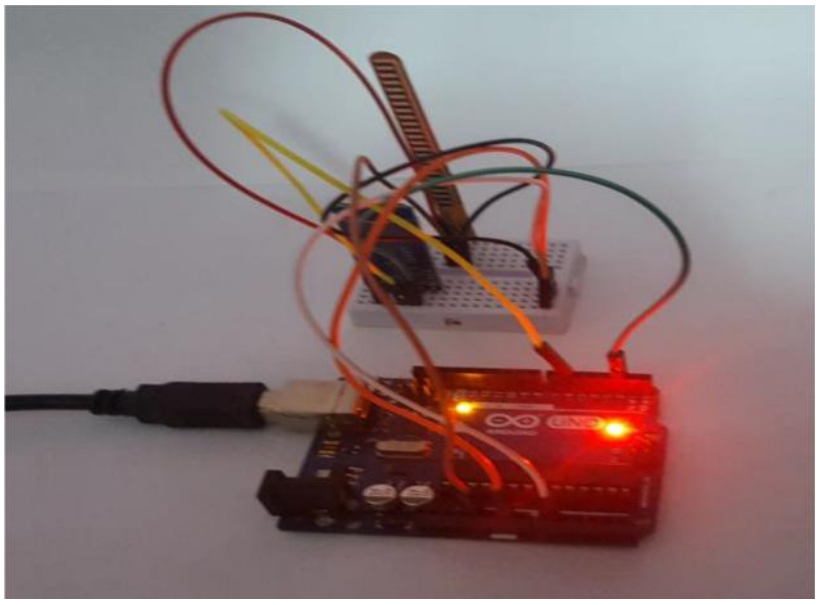

Fig 4:Initial implemented circuit consisting of flex sensors and Bluetooth module

Fig 5: Initial Android application working in action mode

APPLICATION/ FUTURE SCOPE

The main use of this device is to assist people with speaking disability. It is easy to use, portable and reliable device equipped with latest technological advancement. The device can also be used in automation purpose where various gestures can control the working of home appliances. The device can also be effectively used in Artificial Intelligence to study the movement of human and then present it in augmented reality to improve gaming experience and it can also be used for medical.

CONCLUSION

Automated Sign to Speech is an Artificial Intelligence device which with the help of its pattern recognizing algorithm determines the gestures of the hand and with the android application having the database for the particular flex reading reads this gestures based on the reading and provide the particular alphabet. In our initial experiments we were successfully able to get the desired alphabets based on the gesture and further work is going on to integrate this device for a larger database to provide gestures for wordings as well to design a continuous and communicable sentences.

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