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A HAND GESTURE RECOGNITION BASED COMMUNICATION SYSTEM FOR SILENT SPEAKERS

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ABSTRACT

In this paper, a communication system has been proposed which converts sign language used by dumb people into speech. It is done based on the novel hand gesture recognition technique. This solution approach consists of a hardware module and software application. In hardware module- The Gesture recognition is done with the help of sensor glove which consists of 3 accelerometer sensors, a microcontroller and Bluetooth chip which are best positioned in fingers, based on the analysis of Indian Sign Language (ISL) signs. The design of glove and the concept of decoding gestures by considering the axis orientation with respect to gravity and their corresponding voltage levels are discussed. In Software part-- an android application named Speaking gestures have been developed. It receives the data (alphabet/word) via Bluetooth, converts them into text and speaks it out. The entire process of speech synthesis has been tested and the test results displaying the alphabets and words have been shown in android app.

Keywords: Language grammars, Microcontroller and Bluetooth chip.

1. INTRODUCTION

In recent years, hand gesture recognition is mainly used in human Computer interactions. They play a vital role in gaming and control application like tele-robotics, 3-D mouse, and virtual reality controlling. Beyond this, it can also be used in application aiding the physically challenged community like dumb people. Hand-gesture recognition is the primary requirement for conversion of sign language to speech. This paper aims at solving the problem of limited communication abilities of the disabled people who know sign language by transforming it into a form of verbal and vocal communication. Gesture recognition can be done by two major techniques namely vision-based approach and Haptic based approach. Owing to large data processing, low speed response, lighting, occlusion constraints in vision-based approach, the haptic based approach is considered in this paper. Dumb people are usually deprived of normal communication with other people in the society. It has been observed that they find it really difficult at times to interact with normal people with their gestures, as only a very few of those are recognized by most people. Since people with hearing impairment or deaf people cannot talk like normal people so they have to depend on some sort of visual communication in most of the time. Sign Language is the primary means of communication in the deaf and dumb community. As like any other language it has also got grammar and vocabulary but uses visual modality for exchanging information. The problem arises when dumb or deaf people try to express themselves to other people with the help of these sign language grammars. This is because normal people are usually unaware of these grammars. As a result, it has been seen that communication of a dumb person is only limited within his/her family or the deaf community. The work described in this project is with an aim of developing a system to aid deaf dumb people which translate the sign language recognition into text with static palm side of right hand images. This project introduces an efficient and fast algorithm for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign language.

2. LITERATURE SURVEY

HAND TALK: INTELLIGENT SIGN LANGUAGE RECOGNITION FOR DEAF AND DUMB

In this project data glove is implemented to capture the hand gestures of a user. The data glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors output a stream of data that varies with degree of bend. The analog outputs from the sensors are then fed to the PIC (Peripheral Interface Controller) microcontroller. It processes the signals and perform analog to digital signal conversion. The resulting digital signal is displayed in the LCD. The gesture is recognized and the corresponding text information is identified. Text to speech conversion takes place in the voice section and plays out through the speaker. The user need to know the signs of particular alphabets and he need to stay with the sign for two seconds.

SIGN LANGUAGE RECOGNITION FOR DEAF AND DUMB PEOPLE

The system has MEMS sensor for detecting the hand motions. The sensor values are stored on the microcontroller unit. Based on the hand motions the stored outputs are displayed on the LCD and also played through the speaker. Embedded C language is used to write the microcontroller program. MPLAB IDE software is used to develop the system. In this system is detect the hand motions in few seconds and also this system is got 99% accuracy.

HAND GESTURE RECOGNITION USING MICRO-DOPPLER SIGNATURES WITH CONVOLUTIONAL NEURAL NETWORK

Short-range continuous-wave Doppler radar sensors have been mainly used for noncontact detection of various motions. In this paper, we investigate the feasibility to implement the function of a remote mouse, an input device of a computer, by recognizing human gestures based on a dual-channel Doppler radar sensor. Direct conversion architecture, symmetric subcarrier modulation, and band pass sampling techniques are used to obtain a cost-effective solution. An arcsine algorithm and a motion imaging algorithm are proposed to linearly reconstruct the hand and finger motions in a 2-D plane from the demodulated Doppler phase shifts. Experimental results verified the effectiveness of the proposed architecture and algorithms. Different from the frequency-domain "micro doppler" approach, the proposed remote gesture recognition based on linear motion reconstruction is able to recognize definitive signatures for the corresponding motions, exhibiting promising potential in practical applications of human–computer interaction.

3.SYSTEM DESIGN

3.1 EXISTING SYSTEM

The existing system is for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign Language. The idea consisted of designing and building up an intelligent system using group of flex sensor, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures and generate easily recognizable form of output The objective of this project is to develop an intelligent system which can act as a translator between the sign language and the spoken language dynamically and can make the communication between people with hearing impairment and normal people both effective and efficient. After recognizing the gesture, the output is expressed in terms of voice and text for display

3.2 PROPOSED SYSTEM

In our proposed system the communication gap between the normal people and disabled people is reduced. The sign language translator we have developed uses a glove fitted with sensors that can interpret the 26 English letters in American Sign Language (ASL). The glove uses MEMS sensors and accelerometers in different dimensions to gather data on each fingers position and the hands motion to differentiate the letter.

SYSTEM WORKFLOW

The accelerometer sensor detects the movement of the hand and sends the data to the Arduino board.

The Arduino board processes the data and sends it to the Android application via Bluetooth.

The Android application analyzes the data and recognizes the gesture.

The Android application generates voice and text output based on the recognized gesture.

The Android application displays the recognized gesture and the output on the Android screen.

4.1 HARDWARE COMPONENTS

Arduino Uno board

Accelerometer sensor (e.g. ADXL335)

Bluetooth module (e.g. HC-05)
LCD display (e.g. 16x2)
Android smartphone or tablet Hardware setup:
Connect the accelerometer sensor to the Arduino Uno board using jumper wires.
Connect the Bluetooth module to the Arduino Uno board using jumper wires.
Connect the LCD display to the Arduino Uno board using jumper wires.
Power up the Arduino Uno board using a USB cable or a power supply.

4.2 SOFTWARE COMPONENTS

Arduino IDE
Android Studio

4.3 SOFTWARE SETUP

Install the Arduino IDE on your computer.
Install the Android Studio on your computer.
Download and install the required libraries for the accelerometer sensor, Bluetooth module, and LCD display

5. BLOCK DIAGRAM

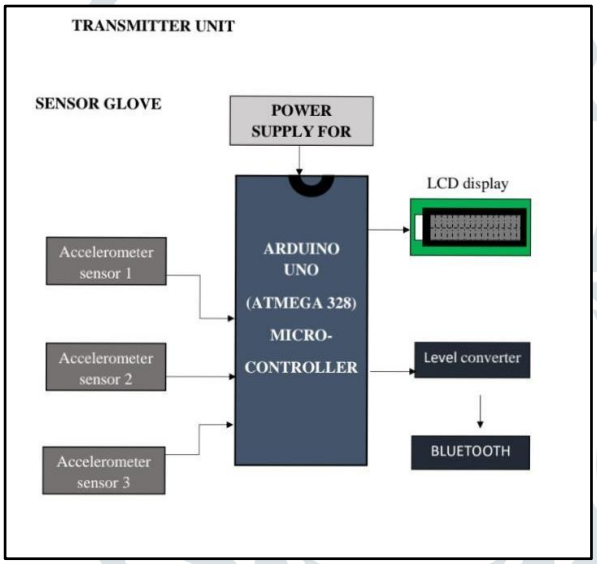

FIG: 1 BLOCK DIAGRAM

6. ANALYSIS STUDY

The ASL signs for the alphabets A to Z which are used by the silent speakers are analysed. Upon analysis, it is found that all the signs can be considered as bending and orientation of the hand. Generally, flex sensors are used to detect the bending of the fingers and accelerometer sensors for sensing the orientation. While proceeding, it was found that though usage of flex sensor produced good results, it was prone to disconnection of carbon link with intensive usage. Also, the sensitivity is less when compared to accelerometer sensors. That even the bends can be considered as orientations. So, the accelerometer sensors will be serving the purpose best.

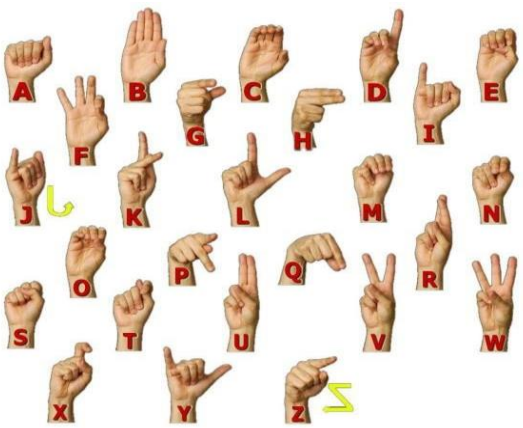

FIG 2 SIGNS OF ALPHABETS

7. SOFTWARE DESCRIPTION

A sketch is the name that Arduino uses for a program. It's the unit of code that is uploaded to and run on an Arduino board. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for Iota applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

8. RESULTS

The system has MEMS sensor for detecting the hand motions. The sensor values are stored on the microcontroller unit. Based on the hand motions the stored outputs are displayed on the LCD and also played through the speaker. Embedded C language is used to write the microcontroller program. Arduino software is used to develop the system. In this system is detect the hand motions in few seconds and also this system is got 99% accuracy. The proposed system successfully recognized different hand gestures and generated voice and text output based on them. The accuracy of the gesture recognition depends on the sensitivity and calibration of the accelerometer sensor. The response time of the system depends on the processing speed of the Arduino board and the Bluetooth connection. The LCD display provided a visual confirmation of the recognized gesture. Discussion The proposed system provides a low-cost and simple solution for gesture recognition without the need for complex machine learning algorithms. The system can be used for various applications such as home automation, gaming, and healthcare. However, the accuracy of the system can be improved by using more advanced sensors and machine learning algorithms. Additionally, the system can be made more user-friendly by providing a calibration feature for the accelerometer sensor and by adding more gestures and corresponding output.

9. CONCLUSION

The proposed system for gesture recognition using an accelerometer, Arduino Uno, Bluetooth module, LCD display, and Android application that generates voice and text output is a low-cost and simple solution for recognizing different hand gestures without the need for complex machine learning algorithms. The system can be used for various applications such as home automation, gaming, and healthcare. The system workflow involves the accelerometer sensor detecting the movement of the hand and sending the data to the Arduino board, which processes the data and sends it to the Android application via Bluetooth. The Android application analyses the data and recognizes the gesture, generates voice and text output based on the recognized gesture, and displays the recognized gesture and the output on the Android screen. The LCD display on the Arduino board displays the recognized gesture. The accuracy of the system depends on the sensitivity and calibration of the accelerometer sensor, and the response time of the system depends on the processing speed of the Arduino board and the Bluetooth connection. The system can be made more user-friendly by providing a calibration feature for the accelerometer sensor and by adding more gestures and corresponding output. Overall, this proposed system provides a simple and affordable solution for recognizing hand gestures and generating voice and text output based on them, making it a promising technology for various applications.

Thus, a portable communication system has been designed using the accelerometer sensors, microcontroller and an android mobile.

The limited communication abilities of the existing systems are overcome by the use of an android mobile application for speech synthesis.

Also the vocabulary and accuracy is relatively good when compared to other speech synthesizers.

Thus, an artificial tongue (android phone) is affixed to the dumb people for effective communication with the society.

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