International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. 08 Special Issue 01 | 2023

Project Dhvani.
Hand Gesture to Speech and Text Conversion with Home Automation.

Atharva Nile[1], Devesh Choube[2], Gaurav Bavaskar[3], Pranav Bade[4]

[1]Atharva.P.Nile, CSE Department, Padm.Dr.V.B.Kolte College Of Engineering ,Malkapur,Maharashtra
[2]Devesh.S.Choube, CSE Department, Padm.Dr.V.B.Kolte College Of Engineering ,Malkapur ,Maharashtra
[3]Gaurav.P.Bavaskar, CSE Department, Padm.Dr.V.B.Kolte College Of Engineering ,Malkapur ,Maharashtra
[4]Pranav.L.Bade, CSE Department, Padm.Dr.V.B.Kolte College Of Engineering ,Malkapur ,Maharashtra

ABSTRACT

In today's world, communication is the most important part of human life.The communication agenda is about expressing emotions by conveying thoughts between the people.But what about those who are mute or deaf from birth or by accident ?For them, body language and facial expressions are the most important means of communication for people with speech impairments. The average person can understand some facial expressions, but not body language.This project provides a solution that not only automatically recognizes user gestures, but also converts them into voice and text formats so that people with disabilities can easily communicate with the general people.The main goal of this project is to make it easy to share key ideas, close the communication gap and make collaboration easier for both deaf and voiceless people. To this end, an automatic sign language recognition system was developed for Arduino. It also aims to develop a useful medical system for paralyzed and dumb people, as well as detecting heart attacks using pulse sensors.

Keywords:Arduino Uno R3 , Bluetooth moduleHC-05,Flexsensor,Microcontroller,Speech,HandGesture.

1. INTRODUCTION

Humans are the most beautiful creatures created by the Almighty. But the harsh reality is that in India, about 2.68 Cr people out of 121 Cr population are “disabled”, 2.21% of the total population, and 7.5% of the population has a speech impediment. Unfortunately, some people lose their ability to speak as a result of an accident. In our daily lives, we observe that the interaction between the silent/silenced patient and the normal person causes many difficulties. Since we know that visual communication is more effective than verbal communication, we will create a system that will benefit our society from the impact of this phenomenon. However, people with this disorder use different methods to communicate with others. The most commonly used method for them is sign language. Sign language allows people to communicate in body language. Each word has a set of human actions representing its expression. To address this issue, we are implementing models that help close the communication gap between deaf people and society. The purpose of this paper is to develop a flexible sensor-based audio command with a gesture recognition module that can effectively convert hand gestures into words. This makes the communication process much easier and more economical, eliminating the need for human translators. Messages are retrieved from a database developed after predictive analysis, allowing you to customize the system to your needs.In recent years, many researchers have been interested in gesture detection and have developed many techniques in the fields of robotics and artificial intelligence . This project uses a similar approach but tries to implement the idea clearly and has an important application in the field of IoT. The device helps mute people to communicate with ordinary people as well as deaf people. Various methods have been implemented by researchers around the world to convert gestures into speech. The motivation for this article came from the idea that (i) a system could interpret many messages using a minimum number of sensors, which made the system less complex to use. (ii) This article provides a method to design faster systems using sensors. (iii) The system must not be damaged by heat and must be shock resistant. To bridge the communication gap between normal, dumb and deaf people, a system was designed to convert gestures into audio and text messages. The proposed system aims to interpret many messages using a small number of sensors. Thus, the system will become lighter and faster.Another main purpose is to provide two types of output, text and audio output, to help mute and even deaf people to communicate.

2. RELATED WORK

The system mainly consists of an Arduino microcontroller and a curvature sensor. A curvature sensor is used to detect gestures. The output of the bend sensor is processed by the Arduino. The output of the microcontroller is then transmitted through the Bluetooth module. An Android device connected to the device uses MIT App Inventor to convert gestures into speech. The system goes back to the sensors worn by people and can measure different reflexes and activities of the human body. Many features are reviewed, such as weight and sensitivity levels. Portable sensors ensure portability of the system. The system according to presents a gesture-to-speech conversion system, which is developed using gesture images of a mute person (subject) captured by a video camera. The image is segmented using a skin region detection algorithm.According to this algorithm, the skin area remains white and the rest of the image becomes black according to the R/G ratio. Feature extraction techniques are used to classify various types of gestures. Use MATLAB to match categorical values to pre-recorded audio tracks in a database. When the subjects gestured with their fingers, the change in resistance was sent to a microcontroller, which converted the signal into an 8-bit binary code, based on which a corresponding message was broadcast using a system of speakers. The system translates the gesture into a voice system and displays the corresponding message.The system uses 5 flexible sensors, one on each finger, attached to the glove with an Arduinonano and a speaker amplifier. Bend sensormeasures the change in resistance of the bend sensor due to finger bending moment.These values were converted to numeric parameters and then matched the values previously entered into memory. The corresponding voice message will be played and the same message will be displayed on the LCD screen.The main method used in this system is image processing.A camera captures an image of the subject's hand. These images are processed using different methods such as color segmentation and feature extraction. Each frame uses the hardware to play the corresponding prefeed sound. The system is a visual method of switching gestures to the audio system. System incorporates flexible sensors that measure finger resistance.The Google Text-to-Speech library is used for text-to-speech conversion. This device must have an active internet connection for text-to-speech. The system presented in uses a bilingual Mandarin-Tibetan speech synthesizer with the support of a deep neural network model and SVM to recognize different facial expressions and hand movements,which will allow the device to incorporate the emotion in the voice tool. The system uses an inexpensive packaging material called Velo-stat. When pressure is applied to it, the resistance decreases.The technology is used to measure the curvature of fingers to recognize gestures. The system uses an accelerometer to measure wrist orientation and a gyroscope to measure angular velocity, and uses hidden Markov models primarily for regional languages.

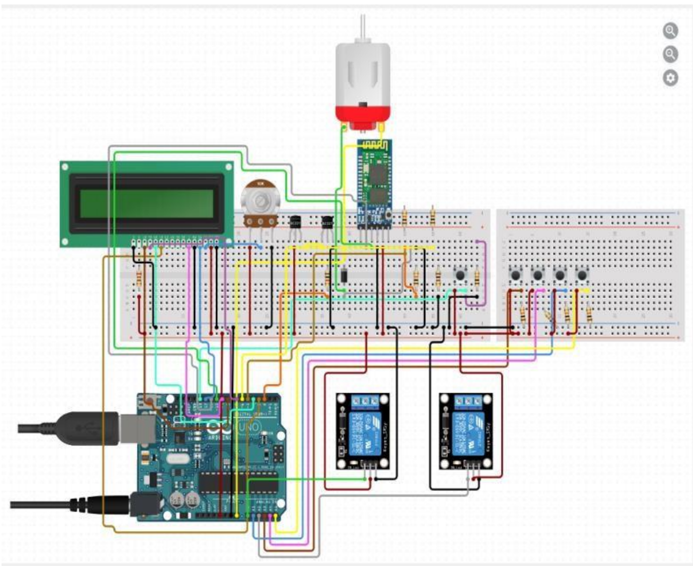


Fig: 1 Block Diagram of system

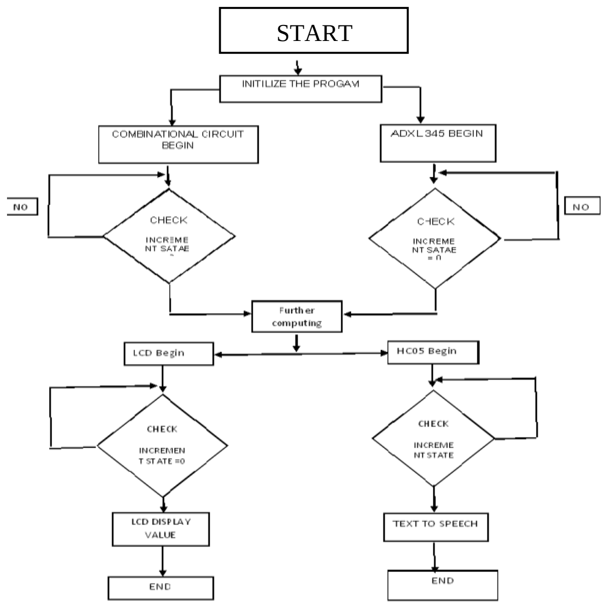


Fig: 2 Flowchart

International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. **08** Special Issue **01 | 2023**

3. METHODOLOGY

The system includes a method for converting gestures into text and audio messages. The integrated prototype contains modules such as a Raspberry Pi 3 microcontroller, curvature sensor, analog-to digital converter, and accelerometer. The architecture diagram is shown in the figure. 1. The operation of the various system modules is described in the following subsections.

3.1. Flexsensor

A bend sensor is a bend-sensitive sensor that measures the resistance caused by bend.The bend is proportional to the magnitude of the bend. The sensors come in strips of 1 to 5 inches.Resistance values range from 10 kOhm to 50 kOhm. The sensor is very thin and light, and the subject feels comfortable.This item uses four flexible sensors, one for each gloved finger. This sensor is used to detect the flexion of the fingers during various gestures.

Fig: 3 FlexSensor

3.2. Accelerometer

Accelerometers are used to measure angular displacement along the three axes x, y, and z, .
An accelerometer is attached to the back of the hand to measure angular displacement when performing various gestures .The capacity of an accelerometer depends on its offset. Accelerometers also represent capacitance changes in analog form.

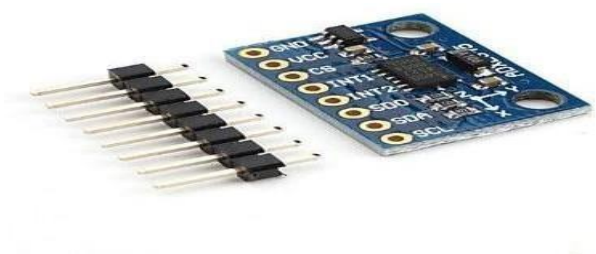


Fig: 4 Accelerometer

3.3. Raspberry PI 3B

Raspberry Pi 3 B As shown in the picture, this is an advanced version of the 3rd generation Raspberry Pi. Has a 64-bit quad-core processor. Broadcom BCN2837 1.2GHz processor.1GB of RAM (Random Access Memory) for faster processing and 40-pin GPIO expansion.Operates on micro USB power with a maximum current of 2.5A There is also a CSI camera port to support a Raspberry Pi camera if required.
It can be powered by connecting to a computer with a USB cable or from a battery**.**

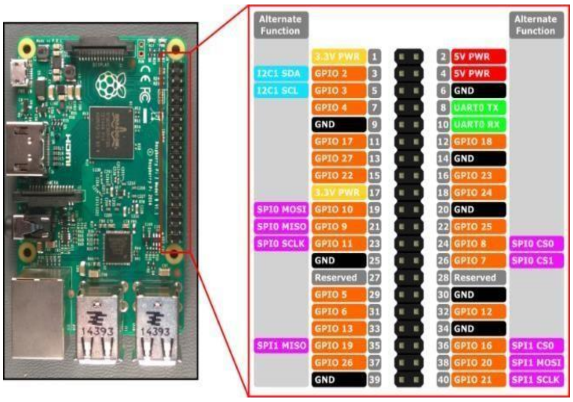


Fig: 5 Raspberry PI 3B

3.4. Arduino Uno

Arduino UNO is used to design the glove, it is a microcontroller board based on ATmega328P. It has 14 digital input/output pins, 6 analog inputs, 16 MHz crystal, USB connection, power connector, ICSP connector and reset button . The Bluetooth speaker is a speaker which is connected to the Arduino via the Bluetooth module and provides a digital signal output for the Arduino. Audio signals are received using radio frequency (RF) waves instead of audio cables. Since our project is intended for permanent use,
it is also possible to connect to the HC 05 and print on the phone.

a) Total output power: 3W
b) Satellite impedance: 4 ohms
c) Signal to noise ratio: 76dB.

Fig: 6 Arduino Uno

4. RESULT AND DISCUSSION

The following steps are used to configure the system.

- Since the device uses the Raspbian operating system, writing the Raspbian ISO image file to a micro SD card will allow it to be installed on the Raspberry Pi board.
- Install VNC Viewer as a virtual application to access the Raspbian interface.
- Install and use the FING app to find your Raspberry pi's IP address.
- Enter the received IP address in the VNC viewer and set a password to protect the system.
- Install Python IDLE to write Python code to program the Raspberry Pi.
- Open a new file and write the necessary Python code for the accelerometer, ADC, Raspberry pi and gesture conversion.
- The Pi can be powered from an external power source via the USB cable.

4.1. Hardware Components Used

Components list	
Aurdino mega (1 pcs.)	Male to female, Male to Male, Female to Female Connecting wire (50 pcs.)
ADXL 345 accelerometer (1 pcs.)	Soldering Flux (1 pcs.)
HC-05 Bluetooth Module (1pcs.)	Glue stick (15 pcs.)
16*2 LCD display (1 pcs.)	1 k resistor (15 pcs.)
Rubber Glove (1 pcs.)	Connecting Wire (5 m)
1amp Power Supply	Metal Contact plates
Custom Application (Flutter, MIT, Andriod Studio)	

4.2. Process Flow

Four flexible sensors are attached to the index, middle, ring and little fingers. They are called f1, f2, f3, and f4, respectively. The bend sensor has a threshold of 30. The answer is positive if the numeric value of the bend sensor is greater than 30, otherwise negative. The accelerometer works both horizontally and vertically, so you can translate both gestures with the same finger position. Accelerometer output is less than 430 (430) in vertical position. A value of 430 is used as the accelerometer's threshold. Again, the 10 kΩ resistor is in parallel with the flex sensor with a 10 kΩ resistor.. The LED in parallel with the speech processor and in series with the LCD to indicate if the board is responding. Arduino now has a built-in ADC that connects directly to the bend sensor.This LCD is connected to the digital pins of the Arduino Uno R3 and the speech processor is connected to the analog pins of the Arduino. There is a RESET button, just to start the program from scratch. There is a Bluetooth module connected to the Arduino. Play the recorded voice corresponding to the specified code in Arduino. recognized gesture is "COFFEE" and a message is displayed on the LCD screen. Likewise, recognized gestures report "FOOD" and "NORMAL" respectively and display the same on the LCD screen.

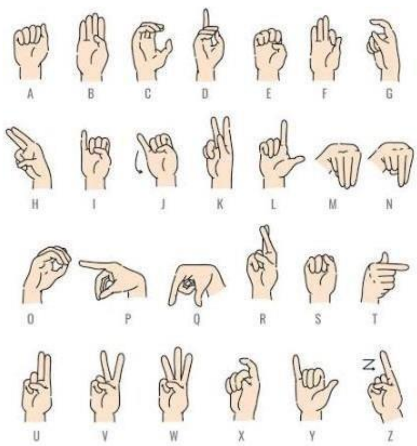


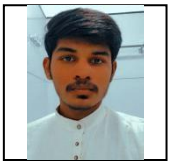
Fig: 7 Sign Language

Fig: 8 Hand gestures

5. Conclusion

A smart, low-cost, portable, cost-effective, lightweight and easy-to-use system designed to help people who cannot speak compared to other suggestion systems. We have successfully implemented 16 different gestures and voice prompts that can help people with speech disabilities express their needs. Thus, the model tries to bridge the gap between slow people and others by outputting them as sounds, which makes it easier for people to understand the actions of stupid people. Moreover, the voice output can be used in any language according to the user's needs. The completion of this prototype shows that more gestures can be used to recognize full sign language, as we have implemented four gestures. We hope to extend the work to other gestures.The device can also be equipped with other sensors, such as gyroscopes and accelerometers, to detect more complex gestures. You can send SMS/email to people far away from the communication area via the smartphone app. Can be used in a variety of applications. For example, you can use the same command to automate electronic equipment, lectures, computer games, and simulate virtual reality. It can also be used to communicate with normal people in public places, such as train stations, airports and medical stores.

AUTHORS PROFILE



Atharva. P. Nile , Undergraduate Student, Department of Computer Science and Engineering ,Padm. Dr. V.B Kolte college of Engineering , Malkapur , Maharashtra. He has interest in database systems, wireless sensor net-works, IoT and big data analytics.

Devesh Choube , Undergraduate Student, Department of Computer Science and Engineering, Padm. Dr. V.B Kolte college of Engineering , Malkapur , Maharashtra. He has keen interest in database systems and IoT.

Gaurav Bavaskar, Undergraduate Student, Department of Computer Science and Engineering, Padm. Dr. V.B Kolte college of Engineering , Malkapur , Maharashtra.He has keen interest in database systems and IoT.

Pranav Bade, Undergraduate Student, Department of Computer Science and Engineering, Padm. Dr. V.B Kolte college of Engineering , Malkapur , Maharashtra.He has keen interest in database systems and IoT.