IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⧋ Peer-reviewed & Refereed journal ⧋ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131261

ASSISTIVE DEVICE FOR HEARING IMPAIRED

Inchara S Shetty, Anchitha

Electronics and Communication Engineering, Alva's Institute of Engineering and Technology,

Mijar, Moodbidri, India

Abstract: Communication of individuals with speech deficits mostly depends on sign language which isn't known to a large number of the general people. And generally it becomes tedious to communicate with a person having only the knowledge of a regional language. This makes different forms of effective communication very challenging. In order to solve this problem, we present an assistive device that converts hand movement into sound and text which can be spoken and read by the speech impaired person, thus enabling interaction with everyone and society at large. Such a system consists of a glove with flex sensors that detects change in resistance applied to certain hand gestures. All these signals are received by an Arduino UNO microprocessor which is programmed to understand these gestures and outputs speech based on these gestures with the aid of a text-to-speech TTS module. In order to make it accessible to more regional areas we used google-text-to-speech(GTTS) module.For making it available for more regional areas we used google-text-to-speech(GTTS). Moreover, the system can use the converted text for visual communication which increases the scope of application of the device. This approach uses recognition of hand gestures and text to speech synthesis to enable speech impaired to communicate in a cheap and efficient way. The device is easy and straightforward which in turn helps to promote diversity and improve the living standards of the users.

Keywords: Speech impairment, sign language, gesture recognition, flex sensors, Arduino UNO, Text-to-Speech (TTS), Google Translate API, LCD display, multilingual communication, assistive technology, communication aid, speech-impaired individuals, accessibility, sign language translation, portability, assistive devices.

INTRODUCTION

Sign language is an essential communication tool for those who have a speech disorder, allowing them to communicate effectively without any verbal speech. However, the general public's poor understanding of sign language generally creates significant communication barriers in most settings. The issue becomes even more complex in multicultural and multilingual settings where people may be fluent only in regional languages. This language gap further intensifies the communication obstacles that face these individuals with speech impediments. Hence, to alleviate such communication challenges, the design of technologies that could mediate the sign language user and the society at large is called for. The above systems should interpret gestures while providing outputs in formats that are accessible to the masses.We propose an assistive device that converts hand gestures into text and speech, which will translate the gap between sign language users and those who do not understand it. The proposed system consists of a glove embedded with flex sensors, which monitor the hand movements. The Arduino UNO microcontroller processes the movements and maps them into predefined messages. After that, these messages are again converted into speech through the text-to-speech (TTS) module. A corresponding text is presented on an LCD screen with two modes of output.

Along with gesture recognition, the system merges software tools like Google Translate API and gTTS for supporting diverse languages. Thus, it caters to communication among users when they are located in heterogeneous linguistic environments. With the conjunction of hardware and software together, this device becomes versatile, adaptable, and very simple by being portable and user friendly for speech-impaired people about communicating their thoughts and wants in daily life.

By combining gesture recognition and TTS technology, the proposed device not only minimizes communication barriers but also fosters inclusion. It provides a very important tool for improving the independence and social integration of the speech-impaired individual by enabling them to communicate more effectively and confidently in many different situations.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024
DOI: 10.17148/IJARCCE.2024.131261

LITERATURE REVIEW

The research has been mainly aimed at developing support systems that translate gestures into intelligible messages for speech-disabled people. One such area of interest involves the employment of flex sensors in wearable form, such as on a glove, for gesture recognition. Gesture recognition through the use of a glove carrying flex sensors involves a method in which the hand movements recognized by the glove are processed via a microcontroller to produce text or speech outputs. This method is simple and cost-effective to translate sign language into audible speech and text for enhancing communication between speech-impaired individuals and the hearing population. The studies highlight that Arduino was used as the primary microcontroller because it is low-cost, flexible, and easy to integrate with various sensors. For instance, one experimental report describes an Arduino-based speech-generating system in which the use of flex sensors located at the fingertips of a glove determine hand gestures. The system converts these hand gestures into text or spoken language, which is thus printed on an LCD display and played through a speaker. Similar Use accelerometers as well as inertial motion sensors to monitor hand and fingers motion more accurately, thus reducing complexity in identifying a host of gestures.

Another system is the sign language glove developed by researchers that can translate hand gestures into visual text and speech, thereby giving an all-round solution to the problem of communication. It makes use of microcontrollers and flex sensors for the detection and processing of hand gestures. The output is then shown on the LCD screen and spoken through a speaker. Such systems can be regarded as a p communication tool between a speech-impaired person and a non-speech-impaired person.

Although much has been achieved so far, existing solutions pose a challenge in the complexity of recognizing dynamic gestures and integration of multiple languages or dialects. Future work hopes to improve these systems through additional gesture recognition capabilities as well as support for more than one language for broader applicability.

PROBLEM STATEMENT

Speech-impaired individuals suffer considerably from communication barriers because of the lesser appreciation of sign language among people in general. Existing sign language recognition systems are usually cumbersome and expensive and are not within easy reach. Such hampers the expression of needs and communication of such individuals with others, especially in multicultural settings. An easily affordable, portable, and accessible system should be developed to fill the gap between the speech-impaired people and others by converting sign language hand gestures into text and speech forms.

PROPOSED METHOD

The proposed system uses an embedded glove along with flex sensors to capture gestures from speech-impaired people, wherein each flex sensor represents the resistance changes as the user bends or curves his fingers during the respective gestures. These signals are given to an Arduino UNO microcontroller that processes the data based on the predefined gesture patterns set in its memory. Wherever a match is generated, the corresponding word/phrase is identified.

Once a text has been identified, it gets converted into audio speech via a Text-to-Speech module, like GTTS (Google Text-to-Speech). The sound produced is heard through the speakers so that the user is verbally conveying his message. Simultaneously, the text would appear on an LCD for the visual output of the message.

It is done through the integration of the Google Translate API, which allows the system to translate recognized text into various languages for communication without linguistic barriers. The translated text is forwarded to the TTS module for speech generation in the chosen language.

SYSTEM ARCHITECTURE

The system architecture proposed for this assistive device enables the individual to communicate in the most effortless manner possible through gesture-to-text and speech translations. Three main components form the basis of this architecture: gesture input, data processing, and output generation. These components work in synergy to form a user-friendly and effective solution to the communication challenges faced by people with speech impairments. The system begins at the gesture input, where a glove embedded with flex sensors is used for detecting the movements of the fingers

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁙ Peer-reviewed & Refereed journal ⁙ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131261

of the user. These sensors measure the variation in resistance, which happens while the fingers bend, allowing this system to sense and capture precise movement of every finger. Each flex sensor represents a finger, while the bending of fingers causes various changes in resistance of these sensors. This variation is converted into an electrical signal, which then is carried to the Arduino UNO microcontroller for processing.

The microcontroller of the Arduino is central to the data processing phase. The analog signals from the flex sensors are received by the microcontroller, which converts them into digital signals through the Analog-to-Digital Converter (ADC) integrated into the microcontroller. The Arduino compares the digital signals with a set of predefined gesture patterns stored in its memory. These gestures are mapped against corresponding words or phrases, which are based on input data. Then, with the correct gesture of the input, the system retrieves corresponding words or phrases and prepares them for outputs. For the output generation, text and speech are used as both forms of communication. The retrieved word or phrase is then displayed at an LCD screen, an output based on the gesture detected. This is very important when the speech output might not be heard clearly, especially in noisy environments. The text displayed on the screen ensures that the message can still be understood visually.The working model is shown below in Fig.1

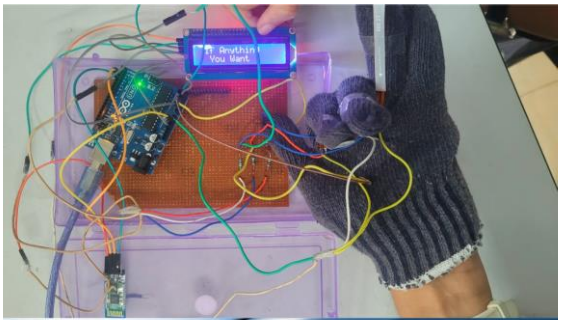

Fig.1. The working model

At the same time, the text that has been recognized is forwarded to a module called Text-to-Speech, like GTTS (Google Text-to-Speech), to transform text into speech. This will be played back by a speaker so that the user will be able to verbally talk to others. The speech output is also clear and natural, like that of humans; hence, others find it easier to understand.

To make the system more versatile, it incorporates the Google Translate API. This allows the recognized text to be translated into other languages, thus making the system able to communicate across language barriers. The translated text is then passed to the TTS module, which generates speech in the translated language, allowing for multilingual communication. This is particularly useful in multilingual settings where communication may be required in multiple languages.

This system's architecture is a comprehensive solution in the integration of gesture recognition, text-to-speech conversion, and multilingual translation. In essence, this means it allows people who are unable to speak to communicate fluently. This is possible due to the use of flex sensors, an Arduino microcontroller, LCD screen, a speaker, and the Google Translate API, thus making the system efficient, accessible, and adaptive to all sorts of communication.

IMPLEMENTATION

The proposed assistive device is implemented using the design of a glove embedded with flex sensors mounted on each finger. These detect the bending of the fingers, which changes the resistance and creates an electrical signal corresponding to specific hand gestures. The signals are communicated to an Arduino UNO microcontroller through analog pins. The microcontroller reads these signals, converting them from analog into digital using its internal ADC. The system is hardwired in a predetermined memory of the microcontroller such that when the sensor signal matches a predetermined gesture, then a given word or phrase is identified.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⋇ Peer-reviewed & Refereed journal ⋇ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131261

Once the gesture is identified, the system produces text output by projecting the corresponding message on an LCD screen. At the same time, the TTS module, such as GTTS, converts the text into speech. The voice is played through a speaker for communication.

To allow multilingual communication, the system uses the Google Translate API. After the system recognizes a gesture and generates the text, it can translate the message into different languages before passing it to the TTS module for speech output in the desired language.

The system is run by a battery and portability, so it provides the opportunity for speech-impaired people to communicate effectively in noisier environments and more multilingual settings.

The block diagram is shown below Fig. 2.

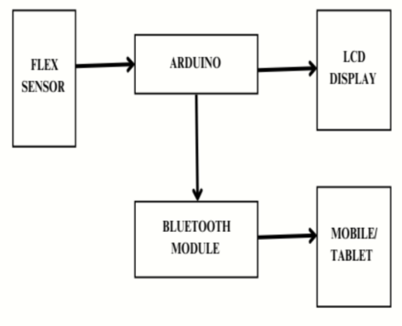

Fig. 2. Block Diagram

CONCLUSION

This is a proposed assistive device which comes up as a new and efficient solution in bridging the communication gap between speech-impaired people and society. The system captures hand gestures using a glove embedded with flex sensors, processes data using an Arduino microcontroller, and converts the recognized gestures into text and speech. The TTS module allows the system to produce audible speech, while the LCD screen provides visual output, thereby ensuring dual modes of communication. The Google Translate API further enhances the versatility of the system, allowing it to communicate in multiple languages. This is highly valuable in diverse linguistic environments and promotes inclusivity and quality of life for speech-impaired individuals. The device, due to portability, light weight, and low energy usage, provides an ideal use in a day-to-day life situation. Combining simple effective hardware components and advanced software features results in a very cost-effective solution in terms of translating real-time gesture communication, and it empowers those with speech impairments into communication more confidently and autonomously. This device might help to a large extent in socially integrating and interactively bringing forward the need and ideas for the impaired speech person into their accessibility.

REFERENCES

[1].Speaking System for Mute People Using Hand Gestures Mrs. Prarthana J V, Ms. Kavya S, Mr.Chethan Kumar S N,Ms. Lata, Mr.Sandeepa [2022 IJRTI | Volume 7, Issue 7 | ISSN: 2456-3315]
[2]. Speaking system for mute people using Raspberry-PI :Dr. K N Nagesh[Volume 5, Issue 4, April-2020].
[3].Design and development of Hand Gesture based Communication Device for deaf and mute people : (1) Omkar Vaidya, (2) Sanjay Gandhe, (3) Abhishek Sharma, (4) AsitBhate, (5) Vishal Bhosale, (6) RushabhMahale[IEEE-2020].
[4].Gesture Aided Speed for Deaf and Mute: (1)Dipti Jadhav, (2) Dr. Amiya Tripathy[IEEE 2018].
[5].Voice of the mute:(1) Amiya Kumar Tripathy, (2) Dipti Jadhav, (3) Steffi A. Barreto, (4) Daphne Rasquinha, (5) Sonia S. Mathew[ICTSD-2015].
[6].Comparative study of hand gesture recognition system: (1) Rafiqul Zaman Khan, (2) Noor Adnan Ibraheem, A.M.U.., Aligarh, India [2016].
[7].Gesture based interaction and implication for the future, (1) Xu Yan, (2) NuerreennisahanAimaiti [Fulltext01 2011]
[8].Conversation system for non vocal people using hand gestures, (1) Mrs. Uzma I Satteekar, (2) Ms. Asmanaaz Pathan SECAB.I.E.T, [2018]

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 12, December 2024

DOI: 10.17148/IJARCCE.2024.131261

[9].S.P. More and A. Sattar, “Hand gesture recognition system “ presented at Int. conf. Electrical, Electronics,Opt.Technique, Chennai, India [2016]

[10].SPEAKING SYSTEM FOR MUTE PEOPLE USING HAND GESTURE Miss. Sonal Dhumal, Mr. Asim Manner, Miss. RoshanTamboli,Mrs.N.S.Hunnargi.[Volume:05/Issue:06/June-2023]

[11] Electronics speaking system for speech challenged people,by Safayet Ahmed, Rafiqul Islam, Md. Saniat Rahman Zishaan, and Md.Rabiul Hassan, published in May 2015.

[12] Smart wearable hand device for sign language interpretation system with sensor fusion, April 2017. B.G.Lee, Member, IEEE, and S.M.Lee

[13] Hand Gesture Recognition for Indian Sign Language, International Conference on Computer Communication and Informatics (ICCCI), 2012, pp 1-4. Ghotkar, Archana S. e-ISSN: 2582-5208 International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal) Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com www.irjmets.com @International Research Journal of Modernization in Engineering, Technology and Science [2545]

[14] Hand Gesture Recognition and Voice Conversion System for Dump People, IEEE International Conference on Intelligent and Advanced Systems, 2019. S. Vigneshwaran; M. Shifa Fathima; V. Vijay Sagar; R. Sree Arshika,

[15] Toshiaki Jima, Byung-woo Min, Ho-sub Yoon, Jung Soh, Takeshi Ohashi, and Byung-woo Min, Recognition of Static/Dynamic Gesture: A Gesture-Driven Editing System,Journal of Visual Languages and Computing, Volume 10, Issue 3, June 1999, pages 291–309.

[16] S.P. More and A. Sattar, Hand gesture recognition system presented at Int. conf. Electrical, Electronics,Opt.Technique, Chennai, India [2016]

[17] K. Murakami and H. Taguchi, Gesture recognition using recurrent neural networks, in Proc. SIGCHI Conf. Hum. Factors Comput. Syst., New York, NY, USA, 1991, pp. 237-242.