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An Artificial Intelligence Based User-Friendly Two-Way Sign Language Translator for Deaf and Dumb People of India

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ABSTRACT:It is challenging for the deaf and dumb to express their requirements in day-to-day interactions. They invented sign language so they could use hand gestures to communicate with others. The main purpose of sign languages is to assist the deaf and dumb. To communicate a certain message, they employ a coordinated and precise set of hand gestures, hand forms, and hand orientation. The Indian Sign Language (ISL) system is one such language set that is primarily utilized in south Asian nations. One feature that sets ISL apart from other sign languages is that it uses both hands and does not have any temporal inflections in its finger spelling chart. Hand gestures are a common way for people with speech and/or hearing impairments in India to interact with others. Except for a small group of people, not everyone is conversant in sign language, thus they might need an interpreter, which can be costly and cumbersome. The goal of this project is to create a portable, intelligent sign language translator with a Raspberry Pi. The goal of the proposed project is to create a portable smart device with a camera module that is interfaced with a Raspberry Pi to record video and identify hand movements made in front of the camera.Following the detection of hand movements, text-to-speech is used to convert the detected gestures into audio, which is then played over a speaker module that is interfaced with the Raspberry Pi and shown on the device's portable display. The creates an intelligent means of communication between the Deaf and Dumb and those who are normal and do not comprehend sign language. The project's implementation of audio to sign language translation makes it more convenient. The microphone is interfaced to the Raspberry Pi, which then uses speech recognition to detect audio, convert it to text, and display it on the portable sign language translator's display for the hearing-impaired individual. Therefore, the suggested project can use deep learning to create a two-way communication channel between hearing-impaired and normal individuals.

Keywords: Sign Language, Raspberry Pi, Translation, Deep Learning, Text, Two-way Speech Recognition, Communication etc.

1. Introduction

In India, there are over 27 national languages spoken, but as far as is known, very few people can speak more than one language. The National Association of Deaf in India estimates that there are approximately 18 million deaf people in the nation, or 1% of the total population. [1] In our daily lives, we have to communicate with each other, either by talking or listening. But when some members of our society

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who are hard of hearing need to communicate with us, we find that it poses a big challenge because we can't fully understand their language and vice versa.Sign language is employed in order to bridge the communication gap between normal individuals and those who are hard of hearing. A sign language recognition system serves as a conduit for communication between the hearing-impaired and the general public. Gestures are movements of any part of the body, primarily hand shapes and facial expressions, used to convey a sign, emotion, or sentiment. Figure 1 illustrates some common gestures that people use in daily life, such as raising their hands, shaking their hands, and shrugging their shoulders.The definition of sign language is an alphabetical system of communication where each word or letter has a designated gesture. Worldwide, a multitude of sign languages are in use [2]. Argentinean Sign Language (ASL), American Sign Language (ASL), Chinese Sign Language (CSL), Arabic Sign Language, Russian Sign Language, Brazilian Sign Language, Japanese Sign Language, Mexican Sign Language, Turkish Sign Language, and many more are among them. Hand orientation, hand forms, and facial expressions are all used in sign language to convey meaning. Although there has been discussion of other languages, our study will mostly concentrate on Indian sign language. In Indian sign language, hand forms can be used to create alphabets; facial emotion is not necessary. Certain words, or perhaps more accurately, phrases, require the creation of both hand gestures and facial expressions.

The most effective means of communication for interacting with the deaf and dumb is sign language [4-5]. Since sign language differs greatly from our everyday languages, sign language interpreters are individuals who have learned the language. According to a survey conducted by the Indian Sign Language Research and Training Centre (ISLRTC), 34 million of the 466 million individuals worldwide who suffer from hearing loss are young people. [6-7] Human-computer interaction (HCI), robotics, healthcare, autonomous self-driving cars, and other fields have seen tremendous growth as a result of the development of artificially intelligent algorithms, big data, and powerful computing power. Applications for HCI can be found in augmented reality, facial recognition, and hand-gesture recognition systems [8]. This project, which falls under the HCI category, attempts to identify different ISL family digits (0-9) and alphabets (a-z). The task of hand-gesture recognition is difficult; in particular, the ISL recognition requires both hands, which makes it more difficult Numerous studies in this area have been conducted in the past utilizing gloves and other sensors, as well. as image processing methods like edge detection and Hough Transform, but the outcomes have not been satisfactory [9]. Yet, the performance of this field has significantly improved with the introduction of new deep learning techniques like CNN, creating a plethora of new opportunities. People with hearing and/or speech impairments in India often communicate with others through hand gestures. With a few exceptions, though, not everyone is conversant in sign language, and they might need an interpreter—which can be costly and inconvenient. Through the use of deep learning and a raspberry pi, this project seeks to close the communication gap by creating a user-friendly device that facilitates two-way communication between the deaf and dumb and the general public [10].

2.PROPOSED WORK

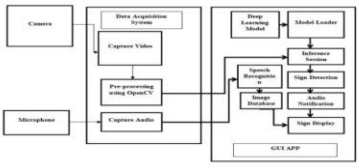

Fig1. Block diagram

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The main objective of the paper shown in Fig 1. is to develop a smart portable device which is used to establish communication with the deaf and dumb people. The objectives of the paper are.

1.To develop a deep learning-based device by interfacing camera to the Raspberry pi which will be able to recognize and predict sign language gestures of the speech and hearing-impaired people.

2.To train a deep learning model capable of hand sign recognition by feeding the images using camera present on the device

3/To implement text to speech system which will convert the detected sign into audio notification and notify the message the deaf and dumb people are trying to communicate.

4. To implement speech recognition system which will use microphone present on the device to perform speech recognition and convert it into sign language to display it on the screen present on the device. This will help two-way communication between the deaf and dumb and normal people.

5. To make the device portable. The proposed system consists of development of portable sign language translator using deep learning and raspberry pi. The system consists of training a machine learning model capable of detection and interpreter of sign languages for deaf and dumb using deep learning and Python.

6.The proposed system consists of a python application which can accept the image data or live video feed form the Camera. The system then uses Deep learning to detect the sign language in video feed and then Interprets it using trained neural network to detect the sign language.

7.The proposed system consists of development of portable sign language translator using deep learning and raspberry pi. The system consists of training a machine learning model capable of detection and interpreter of sign languages for deaf and dumb using deep learning and Pyton

8. The sign interpreted is showed as text on the LCD display interfaced to the Raspberry Pi. The system also converts the detected sign language to English audio and plays using the Speaker interfaced to raspberry pi.

9. Thus proposed system not only can help the deaf and dumb to communicate easily but also avoid the necessity of person with the knowledge of sign language who works as an interpreter between the deaf and dumb people and common people. The proposed system permits two-way communication.

In this paper we have used raspberry pi. Raspberry Pi Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground- breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+ while retaining backward compatibility and similar power consumption. For the end- user, Raspberry Pi Model B provides desktop performance comparable to entry-level x86 PC systems. This product's key features include a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro- HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (via a separate PoE HAT add-

3.SOFTWARE USED

3.1 Python IDLE

Python is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general- purpose language,

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meaning it can be used to create a variety of different programs and isn't specialized for any specific problems. This versatility, along with its beginner-friendliness, has made it one of the most-used programming languages today. A survey conducted by industry analyst firm Red Monk found that it was the second-most popular programming language among developers in 2021 Python is commonly used for developing websites and software, task automation, data analysis, and data visualization. Since it's relatively easy to learn, Python has been adopted by many non-programmers such as accountants and scientists, for a variety of everyday tasks, like organizing finances. "Writing programs is a very creative and rewarding activity," says University of Michigan and Coursera instructor Charles R Severance in his book Python for Everybody. "You can write programs for many reasons, ranging from making your living to solving a difficult data analysis problem to having fun to helping someone else solve a problem."

3.2 OpenCV

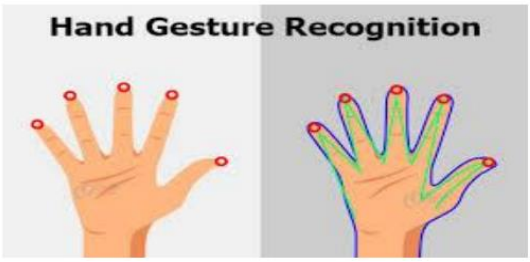

Fig .2 Hand Gesture Recognition

The Fig 2 OpenCV is a cross-platform library using which we can develop realtime computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection. Computer Vision Computer Vision can be defined as a discipline that explains how to reconstruct, interrupt, and understand a 3D scene from its 2D images, in terms of the properties of the structure present in the scene. It deals with modeling and replicating human vision using computer software and hardware.

4. Result and Discussion

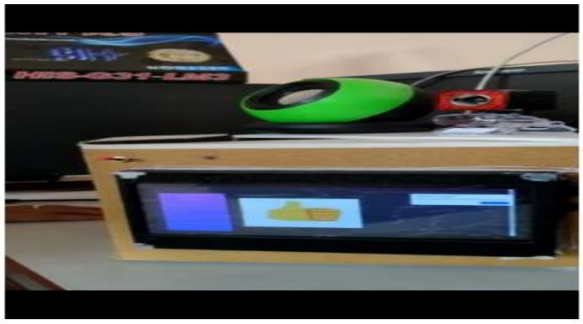

Fig .3 Model of the Project

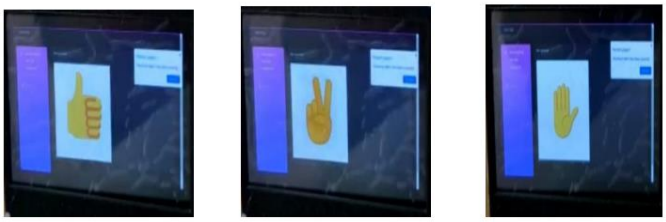

Fig .4 Normal to Deaf and Dumb People

Fig.5 Deaf and Dumb to Normal People

This project aims to narrow this communication gap by developing a user-friendly device which acts as a two-way communication between the deaf and dumb people and normal people using raspberry pi and deep learning.

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5. CONCLUSION

This proposed project presents an innovative concept of the development of user-friendly two-way translator for deaf and dumb people using deep learning. From proposed project we can conclude that the proposed project can help facilitate two-way communication between deaf and dumb people using a portable device which can convert sign language to audio and audio to sign language. This can help bridge the communication gap which exists between the normal people and challenged people due to the lack of sign knowledge. This can also help the challenged people to effectively communicate with normal people as this translator device converts the sign language into audio. Also, the normal people can communicate with the challenged people using this device as it implements speech recognition and conversion of detected speech to corresponding sign. Thus, we can conclude that this device can form effective translation between normal and challenged people by using deep learning and sign gesture recognition.

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