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Sign Language Detection by Image Processing

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ABSTRACT: Speech Impairment is a disability that affects one's ability to speak and hear.
Microprocessor-based speaking device for people who cannot speak is designed to give the signs using the image processing technique. It is a microprocessor-based device, which displays the exact letter on the screen given for that specific hand gesture, where the person can just give the predefined gesture which indicates the sign of water(example) then we can see the output on the screen (image to text). Raspberry pi which is the microprocessor in this project is the heart. It stores the data on the needs of the person. So that it can make use of data stored whenever the person uses this device. This device helps mute people to announce their requirements. Through this, the near person can understand their need and help them. Also, people can communicate over long distances through the video without any communication gap between them. This saves a lot of time to understand each other and provides ease in communication. In human communication, speech and gestures are completely coordinated. Machine gesture and sign Language recognition are about the recognition of gestures and sign language using image processing. We can further customize the device as per the need of the user.

KEYWORDS: Spy Cam, Raspberry Pi, Hand-Gesture, Image processing.

I. INTRODUCTION

People who are deaf and dumb often tend to feel uncomfortable around other people, when drawing attention to their hearing problem. Those people want to be like their friends with good hearing, so this drives a thought in them to mainly keep to themselves and not take part in activities with those normal people. Sign Languages are used by mute people as a medium of communication. Sign Languages are used to convey thoughts with symbols, objects, etc. They also convey a combination of words and symbols (i.e., gestures). Gestures are different patterns made by the curls and bends of the fingers. Gestures are the best medium for their communication.

In recent years, for human-computer interactions, hand gesture recognition is used mainly. They play an important role in gaming and control applications i.e., 3-D mouse, tele robotics, and virtual reality controls. Rather than this, it is also used in those applications which aid the physically challenged community as mute people. So, the primary requirement for conversion of the sign of mute people to speech is Hand-Gesture recognition. The sign recognition project is very useful for mute people, it can also be useful for

patients with half of their bodies paralyzed as they couldn't speak. Thus, we proposed a hardware system to complete this need. The proposed system is completely portable and focuses on two-way communication. The system is being completed with the use of a spy cam, raspberry pi 3, and a memory card.

The main goal of the project is to convert hand gestures to text for communication between mute and normal people. The system includes two modules.

The first module is a spy cam capturing the image/snap and giving it to the raspberry pi microprocessor. The second module is the raspberry pi converting the gesture to readable text through image processing.

In this system, a spy cam is implemented to capture the images of hand gestures and by image processing techniques. The analog outputs from the spy cam are then fed to a raspberry pi. It processes the signals and performs analog to digital signal conversion. The gesture is recognized, and the corresponding takes information is identified. The user needs to know the signs of the alphabet and they need to stay with the sign for 2 sec. There are no limitations for a sign as it is hard to build standard libraries of signs.

The new gestures introduced must be stored in the system. This system will help the users by providing a medium to communicate. It is implemented using devices like spy cameras and raspberry pi 3.

II. LITERATURE REVIEW

[1] A sign language detection device was implemented by G Balakrishnan and P. S. Rajan. In this, the signals were generated for 32 signs specified by the user and according to that the specified text was given as output. Here the gestures were limited.

[2] Many projects and solutions have been reported in the literature to convert sign language into textual or verbal form. One among them is the Cornell University group's work on Sign Language Translation called "The Sound of Signing" which demonstrates it with a hand glove.

[3] A survey paper on 3D of hand gesture recognition methods concludesthat image though image processing gives precise results this method requires a complex model.

[4] Another work on 3D hand gesture recognition uses 2 cameras for hand motion sensing and recognizes the gestures made by the thumb and index finger only.

[5] Christopher Lee and Yangshen Xu developed a glove-based gesture recognition system that recognizes 14 letters from the hand alphabet, learns new gestures, and can update the model of each gesture in the system in online mode, with an intelligent Sign language recognition using an image processing rate of 10 Hz.

[6] Joyeeta Singha and Karen Das proposed a system for Indian sign language recognition from a live video. The proposed system comprises 3 stages, Pre-processing stage which includes skin filtering and histogram matching. For feature extraction, Eigen values and Eigen vectors are considered. For classification eigen value weighted Euclidean distance is considered.

Dataset consisted of 480 images of 24 signs of ISL signed by 20 people.

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III. SYSTEM DESIGN

Figure (a) shows the architectural diagram of Sign Language Detection System

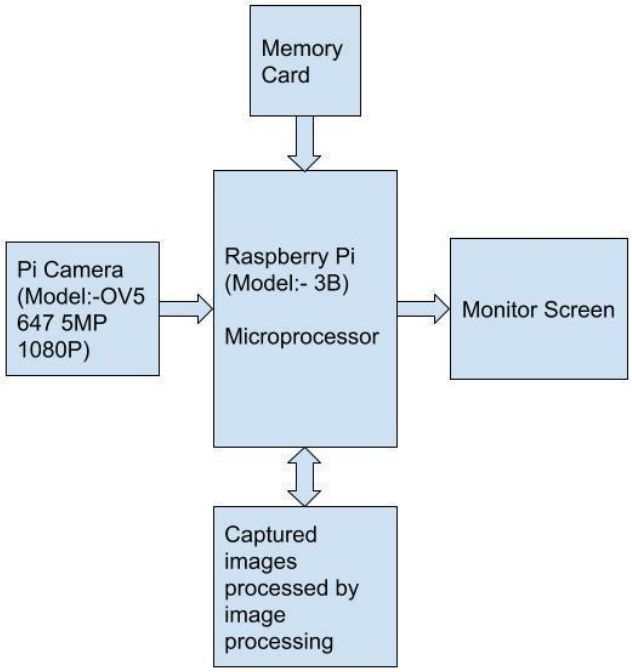

fig.(a):Block diagram of Sign Language Detection System

IV. METHODOLOGY

Pi camera OV5647 is used to capture the hand gesture of the disabled person or to take the snap of gesture shown by user. The Pi camera is connected to Raspberry Pi 3 Model b through camera port. The snap is sent to the controller. Raspberry Pi recognizes the pattern of the input provided by cam through image processing and gives the specified text that is stored for that pattern. Monitor screen will display the text output.

Pi Camera OV5647 5MP is connected to the Raspberry Pi Microprocessor Model 3B. The Pi Camera is used to capture the hand gesture or to take the snap of gesture shown by the user. The Pi cam is connected to Raspberry Pi 3 Model b through the camera port. It is of 5MP and 1080p resolution. It'sdimensions are 32/30/25 means it is very small and light in weight i.e.it is of 3 gm. It is compatible with all models of raspberry Pi and it comes with IR LED which supports night vision, too. As compared to other cameras this is budget friendly, it is of
small size and with good resolution. This will keep our device a bit lighter in weight and avoid the use of any bulky cameras.

Raspberry Pi 3 model B microprocessor has camera port for connecting raspberry Pi camera. It is connected with the Pi camera, memory card as well as with the monitor screen. Raspberry Pi microprocessor is connected with the memory card which has Raspbian operating system installed in it. Microprocessor has the Quad Core processor and 1.2GHz of clock frequency, with 64bit CPU, 1GB RAM. Also, it has Inbuilt wifi and Bluetooth. This microprocessor processes the actual image received by capturing the hand gestures of mute people.

The name of a memory card is San Disk Ultra. It comes with 16 GB storage in which raspbian operating system is installed.

V. HARDWARE DESIGN

Figure (b) shows the image of the hardware design of the proposed Sign Language Detection System.

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fig.(b): Hardware Design of Sign Language Detection System

VI. SOFTWARE SYSTEM DESIGN

Figure (c1) shows the image of raspbian operating system.

fig.(c1): Raspbian Operating System

Figure (c2) shows the image of authentication to VNC server.

fig(c2): Authentication to VNC server

Figure (c3) shows the paired raspbian operating systems with their TCP-IP adresses in VNC viewer.

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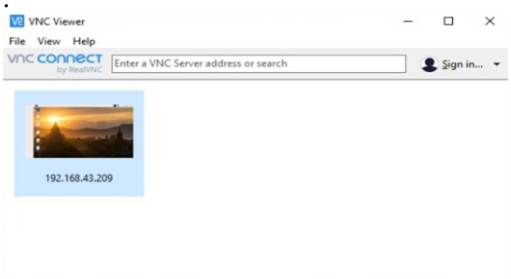

fig.(c3):VNC viewer

Figure (c4) shows the image of command prompt where commands are given to run the device.

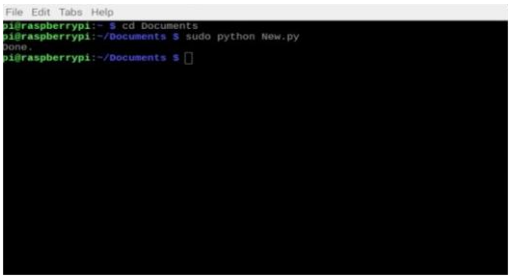

fig.(c4): Command Prompt

VII. RESULTS.

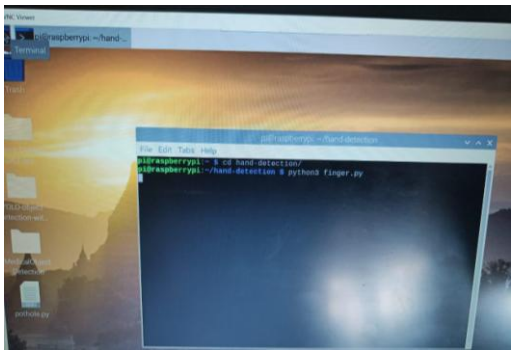

fig.(d1): VNC Server

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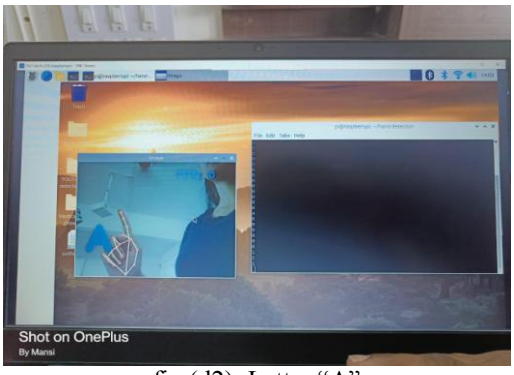

fig.(d2): Letter “A”

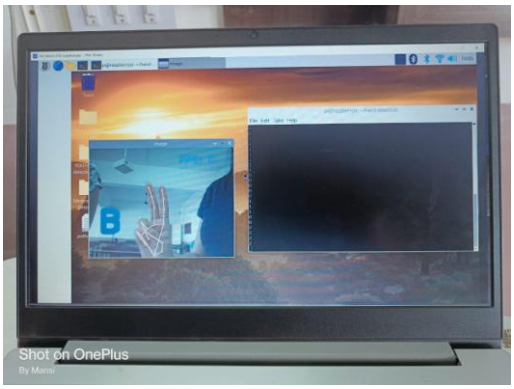

fig.(d3): Letter “B”

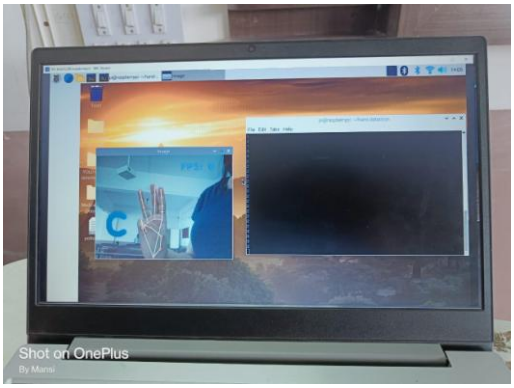

fig.(d4): Letter “C”

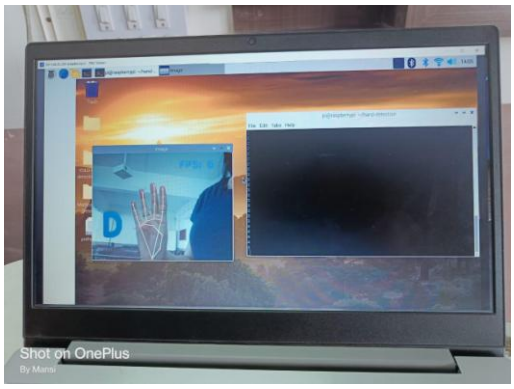

fig.(d5): Letter “D”

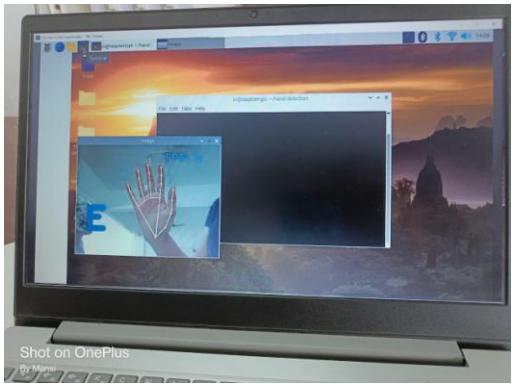

fig.(d6): Letter “E”

VIII. APPLICATIONS

- Gesture recognition and conversion
- As a translating device for disabled people
- It can be used for Mobiles for SMS sending
- Can be used in special schools and NGOs.

IX. CONCLUSION

This system aims to lower the communication gap between the mute community and the normal world. The project proposes a translational device for mute people using spy cam and image processing technology. The proposed technique has enabled the placement of Spy cameras. As in the future, cameras for facial detection can also be installed for better communication. We aim to develop a mute gesture recognizer system for establishing communication between the mute people. Gestures are considered as the most expressive way for communications between humans and computers in virtual.

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