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Sign Language converter for deaf and dumb people

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Abstract – *Deaf and dumb people learn sign language for communication between deaf-mute and normal people. But normal people are unable to understand what the dumb and deaf people are trying to say. Normal people do not have time to learn the sign language. It causes barrier in communication between deaf-dumb and normal people. The work presented in this paper mainly reduces the communication gap between deaf-dumb and ordinary people. A gesture in a sign language is a particular movement of the hands with a specific shape from the fingers and whole hand. This paper aims to convert the hand gestures based on electronic device that translate sign language into text and speech to make the communication between the deaf-mute communities with the general public.*

Key Words: **embedded system, arduino board, image processing system, camera, raspberry pi**

1. INTRODUCTION

Body Language takes back their form to the hoary times back at the days when there were no adequate aid of communication known to the society. Nodding the head or making some signs using hands were an amenable means treated at that. Sign language has been a part of life for the individual's disabled persons. As an aid of conversation, Sign language has been utilized for years by the deaf and dumb community of individuals for carrying out interactive communications. It emphasizes on manual and non-manual signals where the manual signs involve fingers, hands, arms and non-manual signs involve face, head, eye or body.

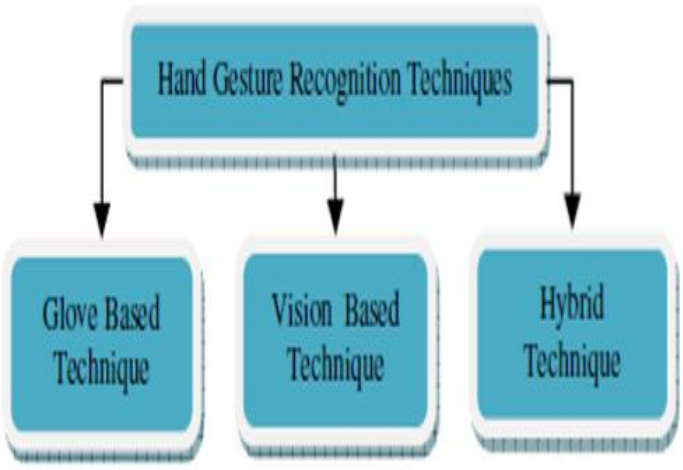
Gesture Recognition has Wide Ranging Applications
1) Developing new standards for hearing impaired.
2) To detect the sign language.
3) Communicating through video calls.
4) To allow learning capabilities to be shared from two or more different places through telephonic conversations.
5) Applying various methods for lie detection.

Dumb/mute people use sign language for communication purpose. Sign language uses gestures instead of sound to convey information. This language includes combining hand shapes, hand movements, facial expressions to express individual's thoughts.

1.1. DEFINITION

- Blind:-Unable to see [uses Braille lippy not language]
- Deaf:-Unable to hear or dull of hearing[uses Sign Language]
- Dumb:-Unable to speak or mute [uses Sign language]

2. CLASSIFICATION OF HAND GESTURE TECHNIQUES

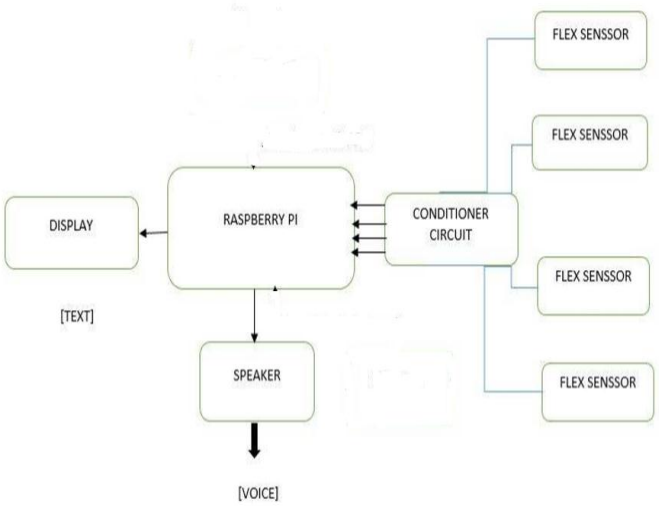


2.1. Classification of Hand Gesture Recognition Techniques-Glove based

Glove based technique can be made by using potentiometer, copper plate or sensors like flex sensor, accelerometer sensor & contact sensor.

Instead of raspberry pi, arduino board(nano or Uno) , Atmega controller(8&16 or 168 or 328 or 2560), ARM processor(LPC2148), PIC controller,8051 can be used.

Output is displayed either on LCD or on mobile through wifi-module or Bluetooth module. Like this text is displayed on LCD or mobile. For obtaining voice output , text to speech converter(TTS) is used. On mobile or laptop or computer, output as voice can be obtained.



2.1.1. Pot and mechanical assembly based glove

A pot is connected to various fingers. This whole assembly is placed on palm. As per finger's moment position, pot varies and resulting in variable voltage.

Drawbacks:

1. This mechanism is uncomfortable and inconvenient for daily use.
2. Also precision required is more but system does not provide enough accuracy to match the requirement.

2.1.2. Copper Plate Based Glove

This glove can be made using small metal strips that are fixed on the five fingers of the glove. A copper plate is fixed on the palm as ground. It is better to use a ground plate instead of individual metal strips because the contact area for ground will be more facilitating easy identification of finger position. The copper plate indicate a voltage level of logic 1 in rest position. But when they come in contact with the ground plate, the voltage associated with them indicate a voltage level of logic 0. Thus necessary gestures are formed.

Drawbacks:

1. Bulky glove
2. Not suitable for long time

Advantages:

1. Very low cost.
2. Less circuit complexity.
3. Smart size.
4. Fast response.

2.1.3. Sensor based glove

The interpreter makes use of a glove based technique comprising of flex sensor, tactile sensor and accelerometer. A signal is produced by the sensors corresponding to the hand sign for each hand gesture and controller matches that gesture with pre-stored inputs. The device translates alphabets and words using made gestures.

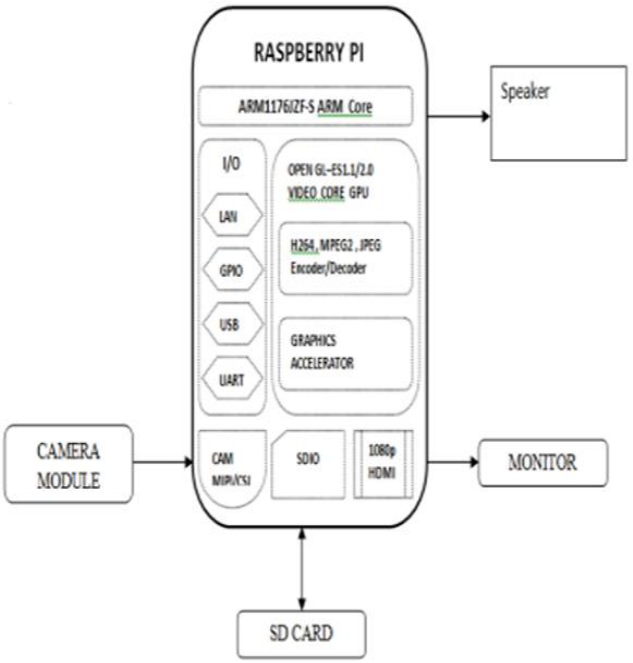
Drawbacks:

1. Strong logic levels are not obtained so we use pull-up resistors in order to obtained strong logic levels.
2. Analog output from flex sensor is in low range.
3. Analog output from flex sensor is less accurate.
4. Highly unstable analog output from flex sensor.
5. More circuits.

Advantages:

Higher accuracy if more sensors are used.

2.2. Classification of Hand Gesture Recognition Techniques-vision based



2.2.1. Using CMOS camera

It transmits image data via UART serial port. Hand Gestures can be obtained by using CMOS camera by 3 following steps

1. capturing the image of gesture
2. edge detection of that image
3. peak detection of that image

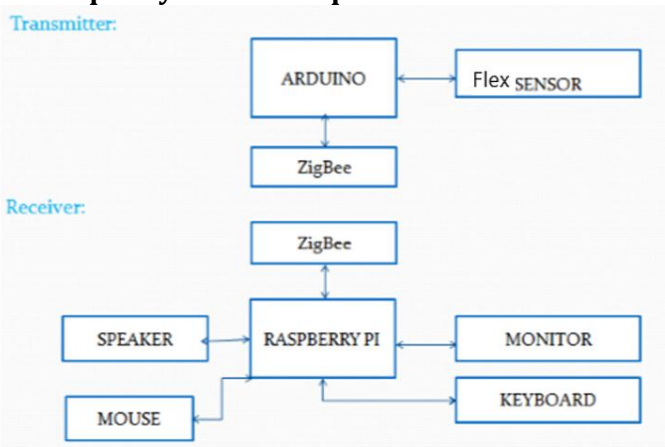
Initially hand gesture image is captured by CMOS camera then we get boundary of hand gesture by detected by edge detection principle. Finally open figures of hand gestures are found by peak detection principle. Using Image processing algorithm, Hand gestures are captured by camera. It needs several ideal situations such as sufficient light and plane background. It's not possible all the time. Another challenge in image and video processing includes variant lighting conditions, backgrounds and field of view constraints and occlusion. The sensor based technique offers greater mobility.

Drawbacks:

1. Latency, It takes approximately 8 sec to capture image
2. Highly expensive
3. Each image occupies nearly 50Kb memory
4. Complex algorithms for data processing.

5.in image and video processing includes variant lighting conditions, backgrounds and field of view constraints and occlusion.

2.3. Classification of hand gesture recognition technique-hybrid technique



This technique is the hybrid of the above two techniques. To make the system more reliable and accurate data from both the techniques are collected and analyzed. The sign language interpreter uses a glove fitted with sensors. Sign is non-verbal form of language, which uses gestures to convey our thoughts. After processing, corresponding audio is produced. Signs are used to communicate words and sentences to audience .There is use of sign speak glove which is a normal, cloth glove fixed with flex sensors along the length of each finger and thumb. Output from the sensor is processed by the raspberry pi and is transmitted to pc side for further processing. The raspberry pi and sensor used in data glove will helps to lower the communication gap between speech and hearing impaired people and normal person.

Drawbacks:

Bulky circuit

Advantages:

Accuracy will increase

3. CONCLUSIONS

The communication between a deaf and hearing person causes a serious problem compared to communication between blind and normal visual people. The review paper aims to facilitate people by means of a embedded based or image processing based communication interpreter system. Deaf people require interpreter system & Hearing machine. Dumb people require interpreter System only.

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