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Sensor less Virtual Talking system for Differently ABLED

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***Abstract:* - How would pink color look like? It would look like how we hear Hamsalekha's music. The word differently abled in the title is to respect the ability of the blind who could imagine that color could be felt from the music. This project is an attempt to a sensor less virtual talking machine for Deaf and Mute people. The image processing technique called skeletonizing is using for converting the sign language in to voice output. This project use camera with the PC with Matlab installed in it. Will these people take this everywhere? No, but they could surely take smart phones. This is a prototype to develop the concept of converting the sign language to speech. The Matlab program which would get the sign's shown by bare hands from the camera and process to understand the sign with the help of the database that would be collected. The Matlab program after guessing the sign would send the wireless data transfer through the Zigbee transceiver. The ZIgbee transceiver in the receiving end would get instruction as what the Matlab program had understood. The received byte would be serially communicated to the microcontroller and the microcontroller would trigger a particular voice from the prerecorded database on the voice replaying board. This Project also extends itself by adding the nether part by having the speech recognition kit, which would be useful in giving the reply to the conversation. The speech recognition kit would get the input from the counterpart and the Serial communicated to get the sign as a reply.**

I. INTRODUCTION

Gestures are expressive, meaningful body motions. Gesture recognition is the process by which gestures made by the user are made known to the system [1]. Gesture recognition is also important for developing alternative human-computer interaction modalities [2]. It enables human to interface with machine in a more natural way. Gesture recognition techniques to make computers 'see' and interpret intelligently are becoming increasingly popular. Our claim is that just as human beings interpret gestures made in any frame of reference by automatically setting the coordinate system in the brain, so should machines. This would enable the machine to better understand and interpret gestures, somewhat like the human brain does [3]. The most structured sets of gestures belong to sign language. In sign language, each gesture has an assigned meaning (or meanings). We will focus on American Sign Language (ASL). ASL is the language of choice for most deaf people. The main purpose of invented ASL is to allow deaf people communicate with normal people. ASL consists of approximately 6000 gestures of common words with finger spelling which are use to communicate proper nouns. Finger spelling can be performs by one hand and 26 gestures to communicate the 26 letters of the alphabets.

There are various types of systems and methods available for sign languages recognition. Our approach is robust and efficient for static symbol recognition and translation of ASL. We used pattern recognition system to recognize hand gesture for ASL, because it is fast and simple algorithms. Pattern recognition is the assignment of some sort of output value to a given input value, according to some specific algorithm. Proposed Point pattern matching algorithm finds the matching points between test and target images. By using this approach we can recognize

II. RELATED WORK

There have been several methods that attempted Sign recognition for various languages. Specifically, [4] used finger tip detection. In [4] edge detection algorithm (Canny edge operator) and boundary tracing are used. Hand gestures are recognized automatically using the data such as the shape and the kinematics of the compressed arm trajectories [4]. The hand is detected using attributes like its motion and the skin color [5]. Hand shape estimation under complex backgrounds is done by adding the models having only the position and velocity of the

hand [6]. The image of the hand gesture is captured and converted into feature vectors [7]. The hand gesture input is taken with the help of a data glove and artificial neural networks are used to recognize the gesture. Hand gestures are represented in terms of hierarchies of multi scale color images. In some systems more than one feature extraction methods and neural networks are implemented to recognize the gestures made by hand.

III. LITERATURE SURVEY

In sensor based detecting technique, previously tri-axial accelerometer along with electromyogram (EMG) sensor was used [1]. Cost was the major problem with sensor based devices and was not affordable by layman. Earlier the hand gloves with sensor were used to\ detect the motion of the finger and hand. The detected movements were used as control input to gaming devices and music devices. As the gloves were not handy and recognized very limited hand gestures the replacement was not that successful [2]. The present project employs a similar kind of hand gloves with sensor but much more handy and can precisely determine many hand gestures. The programming algorithm, which is used, enables the use of the same gloves for different people once tuned to their hands. Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed *edges*. The same problem of finding discontinuities in 1D signals is known as step detection and the problem of finding signal discontinuities over time is known as change detection. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction. Edge properties The edges extracted from a two-dimensional image of a three-dimensional scene can be classified as either viewpoint dependent or viewpoint independent. A viewpoint independent edge typically reflects inherent properties of the three-dimensional objects, such as surface markings and surface shape. A viewpoint dependent edge may change as the viewpoint changes, and typically reflects the geometry of the scene, such as objects occluding one another. A typical edge might for instance be the border between a block of red color and a block of yellow. In contrast a **line** (as can be extracted by a ridge detector) can be a small number of pixels of a different color on an otherwise unchanging background. For a line, there may therefore usually be one edge on each side of the line. Skeletonization (i.e., skeleton extraction from a digital binary picture) provides region-based shape features. It is a common preprocessing operation in raster-to-vector conversion or in pattern recognition. There are three major skeletonization techniques: detecting ridges in distance map of the boundary points, calculating the Voronoi diagram generated by the boundary points, and the layer by layer erosion called thinning. In digital spaces, only an approximation to the "true skeleton" can be extracted. There are two requirements to be complied with: *topological* (to retain the topology of the original object), *geometrical* (forcing the "skeleton" being in the middle of the object and invariance under the most important geometrical transformation including translation, rotation, and scaling)

IV. EXISTING METHOD

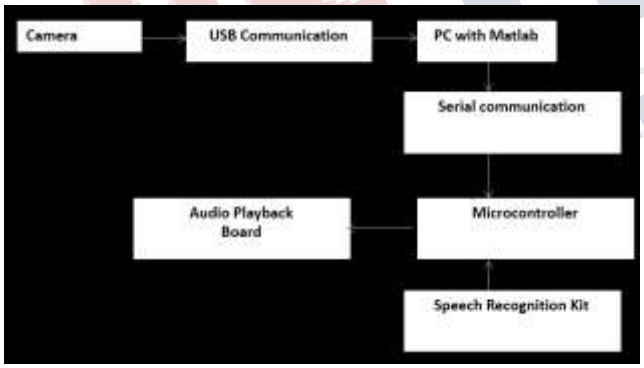
The existing method would use either the Flex sensor is used. FLEX SENSOR: In this device the hand gestures are recognized using flex sensor. These sensor are attached to the gloves. Flex sensor are similar to potentiometer, i.e. variable resistor. The resistance of the sensor varies according to the amount of its bending, which intern depends on the movement of finger. In order to precisely measure the bending flex sensor are used. The flex sensors have an average flat resistance about 10k ohms. When the sensor are bent the resistance offered by them increases. Adult human hand

Usually has a finger size above 90mm. The sensor size is so chosen that its size is greater than the size of the finger so that the bending can be precisely measured. The size of the sensor here employed is about 112mm and has a thickness of about 0.43mm.Gestures which are made are converted to equivalent electrical signals by the sensor. These signals are sent to input pins of the MSP430F149. For different gestures the signals are different. A range of ADC values [12bit ADC assumed] is assigned for each gesture; the corresponding word would be stored in the memory. When the controller receives these signals it compares with the stored values and the corresponding

word is selected and the word is spoken out of the speaker. Speaker here can be inbuilt in the device or the headphones can be used. The corresponding word is simultaneously displayed on the LCD.

V. PROPOSED METHOD

Already image processing algorithm [1] [2] has been used for implementing the sign language decoding. But the considering the computational complexity this project would deal only the combination of edge detection technique and skeletonizing technique to implement the sign language decoding. The decision of implementing the vision based rather than the sensor based technique can into play, as the smart phones are really becoming more and more process efficient. And the simplification of the algorithm was taken into consideration in order make the algorithm to be implemented even on the cheaper mobiles. . The Matlab program which would get the sign's shown by bare hands from the camera and process to understand the sign with the help of the database that would be collected. The Matlab program after guessing the sign would send the wireless data transfer through the Zigbee transceiver. The ZIgbee transceiver in the receiving end would get instruction as what the Matlab program had understood. The received byte would be serially communicated to the microcontroller and the microcontroller would trigger a particular voice from the prerecorded database on the voice replaying board



Hardware Details: Overview: CC2500 RF Module is a transreceivermodule which provides easy to use RF communication at 2.4 Ghz. It can be used to transmit and receive data at 9600 baud rates from any standard CMOS/TTL source. This module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding toIt works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time

Features: Supports Multiple Baud rates (9600) Works on ISM band (2.4 GHz) No complex wireless connection software or intimate knowledge of RF is required to connect our serial devices. Designed to be aseasy to use as cables. No external Antenna required. Plug andplay device. Works on 5 DC supply.

Specifications:

- Input Voltage - 5Volts DC
- Baud Rate - 9600
- RS 232 Interface & TTL Interface
- Range – Max 30 Mtrs - Line of Sight
- Channels- 3Ch - JP1& JP2 - Ch1 On–On

Microcontroller's introduction: With this board you can develop and prototype with any of 8051 40 pin microcontrollers with ADC Based Projects , ADC 0809 is a 8 Channel 8 bit ADC . The board have User button and status LED. The bridge rectifire allow this board to be powered with both AC and DC power supply adapters.

FEATURES

- DIL40 microcontroller socket
- Quartz crystall 11.05892 Mhz
- 2 test Led for Output
- DIL28 ADC 0809 socket
- 1k pots for ADC Input
- Clock Generaton using 555
- Reset button
- LCD Interface
- RS232 Interface
- Power plug-in jack
- Extension slot on every uC pin
- GND bus
- Vcc bus

Software Used:
Matlab
Keil Compiler
Flash Programmer

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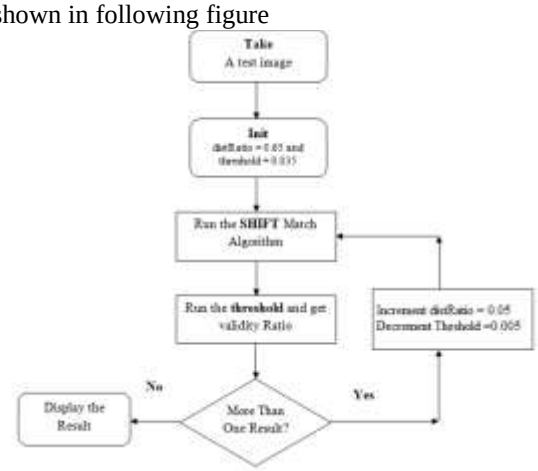
VI. HAND GESTURE RECOGINITION (HGR)

Pattern recognition systems often require matching two sets of points in space. This is because the analysed images are raster graphics or the extracted features are pixels subset of the original image. For this point pattern matching algorithm is the best solution. Point pattern matching algorithm provides a navel approach to achieve a matching of adequate quality in a efficient and robust manner. For hand gesture recognition of ASL sign, we used point pattern matching with SHIFT match algorithm. The flowchart of proposed algorithm is as shown in following figure



Flow Chart of Point Pattern Matching Algorithm

The working of point pattern matching algorithm is as follows:

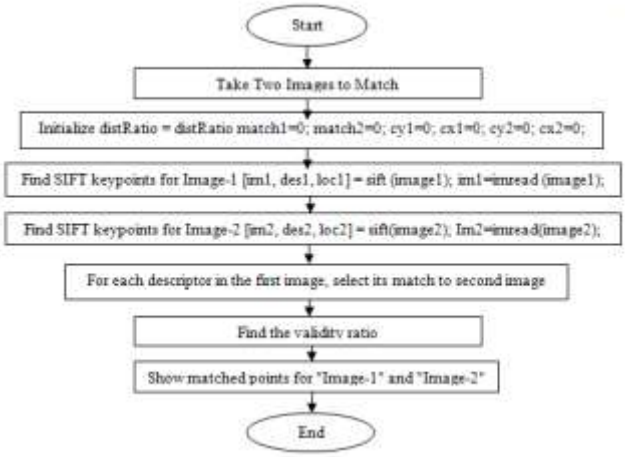
1) Take a test image
2) Initialize the distRatio = 0.65 and threshold= 0.035
3) Run the SHIFT match algorithm
4) Key point matching starts its execution by running the threshold. It gets the key point matched between test and all 26 trained images. We get the validity ratio.
5) Check that we got more than one result or not.
6) If we get more than1 result then increment the distRatio by 0.05 and decrement the threshold by 0.005 and repeat the steps from 3 to 5.
7) If we get only one result then display the result.

VII. SHIFT MATCH ALGORITHM

During the test implementation, the point pattern matching algorithm is executed. In point pattern matching algorithm, SHIFT match algorithm is executed for finding the matched keypoints between two images. In SHIFT match algorithm, image1 and image2 are taken as a two images to match. For our case the first image is one of the database images and image2 is the input (query or test) image. distRatio is the parameter of SHIFT algorithm. In the original implementation, this parameter is set as a constant. For our algorithm's recursively we made it a variable parameter and threshold is the threshold value for the MK-RoD algorithm. Here, for finding the shift keypoints of an image the function shift is called which finds the keypoints with the combination of image, description and location of given image. Image(im): the image array in double format

Descriptors (des): a K-by-128 matrix, where each row gives an invariant descriptor for one of the K keypoints. The descriptor is a vector of 128 values normalized to unit length.

Locs (loc): K-by-4 matrix, in which each row has the 4 values for a keypoint location (row, column, scale, orientation). The orientation is in the range [-PI, PI] radians. Following figure



VIII. MK-ROD ALGORITHM

For finding the validity ratio MK-RoD algorithm is used. For example, figure shows the two images for finding the validity-ratio.

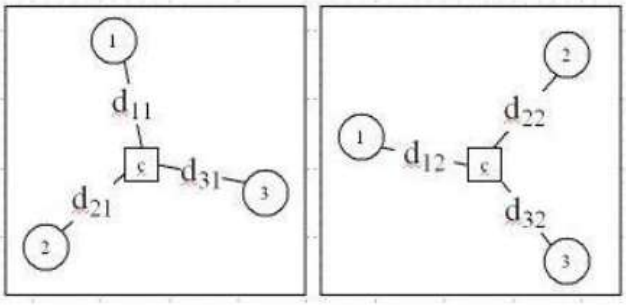


Figure Representation of (a) Trained Database Image (b) Test Input Image with Key points

- C - Denotes the center points
- D - Denotes the distance mask
- T - Denotes the No. of test image to match
- M -Denotes the No. of Matched Points 1, 2, 3 are the key points.

The procedure to find the Validity ratio of One Trained Database Image versus Test Input Image is as follows

- $dT1 = \sum_{i=1}^{M} di1$
- $dT2 = \sum_{i=1}^{M} di2$
- Ratios 1= [d11/dT1 d21/dT1 d31/dT1]
- Ratios 2= [d12/dT2 d22/dT2 d32/dT2]
- Distance Mask= abs[Ratios 1- Ratios 2] < (Threshold Value)
- Valid Points = sum(Distance Mask)
- Validity Ratio= (No. of Valid Points) / (No. of Matched Points)

Once we got the validity ratio, mask the distances by taking the absolute which are below the algorithm's threshold. This operation is done in order to determine the similar pattern of the matched keypoints from the center of the matched keypoints. The absolute of the difference of the points which are below the given threshold are treated as valid matched keypoints.

IX. CONCLUSION

Gesture is one of the most natural and expressive ways of communications between human and computer in a real system. We naturally use various gestures to express our own intentions in everyday life. Our method recognizes all the static symbols of American Sign Language successfully by using point pattern matching algorithm. Point pattern matching algorithm provides the emerging approach for hand gesture recognition. This algorithm can recognize gestures having open as well as closed fingers more effectively. So it provides the simple and novel way to recognize the signs.

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