Gesture recognition system for deaf and dumb

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ABSTRACT:-

Gesture means a image of part of body. Gesture/posture Recognition is the technology that recognize the posture of body. It recognizes hand, arms, head or any part of the body. So the goal of Gesture Recognition is to provide interface of human body with computer via mathematical algorithm. This paper gives a real time vision based method for recognizing human body image using MATLAB.A number of hardware techniques are used for gathering information about body positioning; typically either image-based (using cameras, moving lights etc) or device-based (using instrumented gloves, position trackers etc.), although hybrids are beginning to come about. However, getting the data is only the first step. The second step, that of recognizing the sign or gesture once it has been captured is much more challenging, especially in a continuous stream. In fact currently, this is the focus of the paper.

KEYWORDS:-gesture,feature,vision,image

1. INTRODUCTION:-

This paper presents how to lower the communication barrier between the mute communities with the general public. So, this is recquired of developing an electronic device that can translate sign language into commands in order to make the communication. A gesture in a sign language is a particular "movement of the hands" with a specific shape made out of them. A sign language usually provides sign for whole words. There are some people who don't have the ability to speak or they lose it in an accident. They find it difficult to express their thoughts or to convey their message to other people. This project can be a medium between dumb deaf people and society. Dumb people throughout the world use sign language to communicate with others; this is possible only for those who have undergone special trainings. Common people also face difficult to understand the gesture language. To overcome these real time issues, we are developing this system. This reduces the communication gap between dumb and ordinary people**.**

- "Speech" and "gestures" are the expressions, which are mostly used in communication between human beings. In human communication, the use of speech and gestures is completely coordinated. Therefore we have used 'Gesture' as key thing in our project.

- A number of hardware techniques are used for gatheringinformation about body positioning; typically either image-based (using cameras, moving lights) or devicebased(using instrumented gloves, position trackers).

2. LITRATURE SURVEY

Hand posture recognition still an open research area .Different techniques and tools have been applied for handling gesture recognition system, vary between mathematical models like Hidden Markov Model (HMM) [6][10] and Finite State Machine(FSM) [6][1] to approaches based on software computing methods such as fuzzy clustering [12], Genetic Algorithms (GAs) [3] and Artificial Neural Network (ANN) [4][5], since the human hand is a complex articulated object with many connected joints and links.Typically the implementation of gesture recognition system required different kinds of devices for capturing and tracking image/ video image [6] such as camera(s), instrumented (data) gloves, and colored marker [6]. Those devices are used for modeling the communication between human and environments rather than traditional interface device such as keyboards, and mice which are inconvenient and unnatural for HCI(human computer interface) system.Many methods for hand gesture recognition using visual analysis have been proposed for hand gesture recognition. Sebastiean Marcel, Oliver Bernier, Jean Emmanuel Viallet and DaniealCollobert have proposed the same using Input-output Hidden Markov Models. Xia Liu and Kikuo Fujimura have proposed the hand gesture recognition using depth data. For hand detection, many approached uses color or motion information. Attila Licsar and TamasSziranyi have developed a hand gesture recognition system based on the shape analysis of the static gesture. Another method is proposed by E. Stergiopoulou and N. Papamarkos which says that detection of the hand region can be achieved through color segmentation. Byung-Woo Min, Ho-Sub Yoon, Jung Soh, Yun-Mo Yangc and ToskiakiEjima have suggested the method of Hand Gesture Recognition using Hidden Markov models. Another very important method is suggested by Meide Zhao, Francis K.H. Quek and Xindong Wu. There is another efficient technique which uses Fast Multi-Scale Analysis for the recognition of hand gestures as suggested by Yikai Fang, Jian Cheng, Kongqiao Wang and Hanqing Lu.

In the recent years, there has been tremendous research on the hand sign recognition. The technology of gesture recognition is divided into two categories

2.1 Vision-based

In vision-based methods [1], computer camera is the input device for observing the information of hands or fingers. The Vision Based methods require only a camera, thus realizing a natural interaction between humans and computers without the use of any extra devices. These systems tend to complement biological vision by describing artificial vision systems that are implemented in software and/or hardware.

2.2 Glove-based

In glove based systems [7], data gloves are used which can archive the accurate positions of hand gestures as its positions are directly measured. The Data-Glove based methods use sensor devices for digitizing hand and finger motions into multi-parametric data. The extra sensors make it easy to collect hand configuration and movement. However, the devices are quite expensive and bring much cumbersome experience to the users some of the earlier gesture

recognition systems attempted to identify gestures using glove-based devices that would measure the position and joint angles of the hand. However, these devices are very cumbersome and usually have many cables connected to a computer. This has brought forth the motivation of using non-intrusive, vision-based approaches for recognizing gestures Also the sensors used for the detection of the sign language and the gesture recognition in the system that are available in the market are quite costly. In computer recognition of spoken language, speech data is captured using a microphone connected to an ADC. Similarly a data-capturing device is also required in order to recognize sign language; in this case measuring the position.

3.PROPOSED MODEL

Over the last few years, number of researches is conducted on hand gesture recognition for human computer interaction using MATLAB and openCV. Several performance comparisons are conducted to improve the technique.

Here, the hand gestures are taken by a camera. Image transformations are carried out on the RGB image to convert into YCBCR image. The YCBCR image transformed into binary image. This algorithm needs uniform and plane background. Edge detection algorithm is used to find the edges in the image. By making use of edge detection the orientation of hand is detected. The features like centroid, peaks detection, Euclidean distance and thumb detection are found. In this paper, they have considered five bits to represent the hand image. That is first bit represents whether the thumb is present or not. If it is present, the bit is given as 1 else 0. Remaining four bits represents the four fingers. The success rate is 92% with computation time 2.76 seconds. The algorithm is implemented in MATLAB.
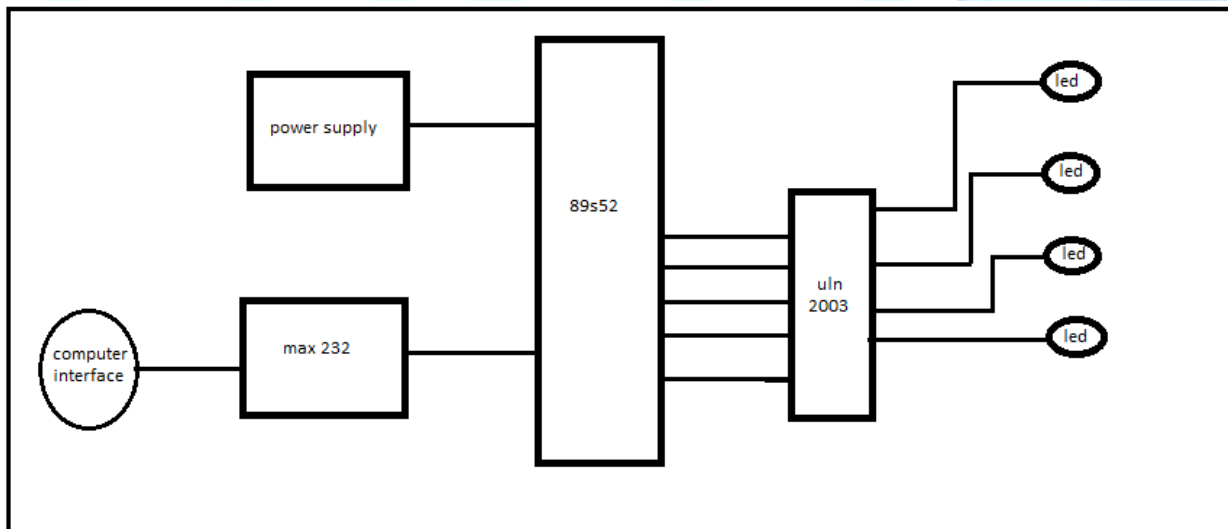

Fig1:- block diagram of gesture recognition system

The components are following as:-
- **MAX232-**the MAX232 is a integrated circuit that converts signsl from serial port to signal suitable for use in TTL compatible logic circuits. It is dual driver/receiver and typically converts the RX,TX,CTS and RTS signal.
- **8952microcontrolle**r- 89C52 is an 8-bit microcontroller and belongs to ATMEL'S family.it has 8KB of flash programmable and erasable read only memoryand 256bytes

of RAM. AT89C52 has an endurance of 1000write/erase cycles which means it can be erased and programmed to a maximum of 1000 times.

- **Uln2003**- the ULN2003 is an array of seven NPN darlingtontransisitors capable of 500mA,50v output. It features common cathode flyback diodes for switching inductive loads .it is known for its high current, high voltage capacity. The drivers can be paralled for even higher current output.
- **LEDs**- light emit diode is a semiconductor device that emits visible light when a electric current passes through it. The light is not particularly bright, but in most LED it is monochromatic,occurring at a single wavelength.

3.METHODOLOGY

3.A.a.Algorithm-1

The proposed method is obtaining the image through subtract one image from another sequential image, measuring theentropy, separating hand region from images, tracking the hand region and recognizing hand gestures. Through entropy measurement, they have got color information that have near distribution in complexion for region that have big value and extracted hand region from input images [1].

*Step-1:*Take the image sequence
*Step-2:*Diference image of the neighbourhood frames
*Step-3:*For each sub-block, evaluate PIM
*Step-4:*Get mean and variance for PIM values
*Step-5:*Extractio of the hand region
Step-6: Contour extraction using centroid and Chain code
Step-7: Get the centroidal profile
If no go to step-2

3.A.b Algorithm-2

The experiment described in this paper collects and classifies sEMG signals associated with a set of hand gestures. Thegoals are

(1) to show the feasibility of using classification of surface electromyogam (sEMG) signals collected from ahuman's forearm muscles to predict the specific hand gesture associated with a set of signals,

(2) improve the classificationaccuracy, and

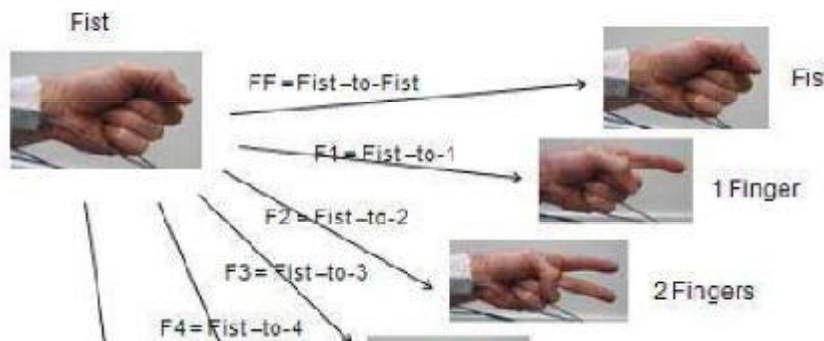(3) simplify the classification model by reducing the feature set[3].

Fig 2: six hand gesture transitions using algorithm 2

3.A.c. Algorithm-3

The major task of this is to build an explicit model of the background Segmentation is then performed to extract foreground objects by calculating the difference between the current frame and the background model. A goodalgorithm should be robust to changing illumination conditions, able to ignore the movement of small background elements, and capable of incorporating new objects into the background model [2.]

Step-1: input video stream

Step-2: preprocessing the stream for background modeling

Step-3: foreground detection

Step-4: postpprocessing the stream

Step-5: obtain the foreground mask

Step-6: background modeling

Step-7: obtain the background model from foreground detection

3.A.d. Algorithm-4

The procedure starts by acquisition phase. As the standard input devices like keyboard, position & pointing devices are has been declared as non grata for this domain of applications. Our endeavor was oriented towards possible alternatives for user friendly and smart interfaces inspired by natural behavior of the users in real-world scenario [2]. While making the choice of image capturing devices they have to look the point of installation as well.

*Step-1:*Take the Captured image as image sequence

*Step-2:*Background subtraction, Hand Detection.Locating hand position using Haar Cascade.

*Step-3:*Camshift, Lucas kanade optical flow.Perform Hand Tracking.

*Step-4:*Find and exyract biggest contour (Area). Finding convex hull of the contour.

*Step-5:*Count number of defects. Find orientatio about bounded rectangle.

*Step-6:*Modeling of Gesture. Interpret gesture to meaningful command.*Step-7:* Perform appropriate action.

3.B. RESULT

Fig 3: recognized 3 different postures in algorithm

In the experimental results for 3 kinds of hand gesture, it shows the recognition rate with more than 95% for person and 90~100% for each gesture at 5 frames/sec by entropy analysis method.[1]

In the second algorithm they are using different Classifiers: Artificial Neural Network (ANN), Random Forest (RF), One Nearest-Neighbor (1NN), Decision Tree with Boosting (DT/B), Support Vector Machine (SVM), and Decision Tree (DT).

3.C. ISSUES TO HAND GESTURE RECOGNITION: EXTRACTION METHODS AND FEATURES EXTRACTION

Most of the researchers classified gesture recognition system into mainly three steps after acquir -ing the input image from camera(s), videos or even data glove instrumented device. These steps are: Extraction Method, features estimation and extraction, and classification or recognition as illustrated in Figure 5.
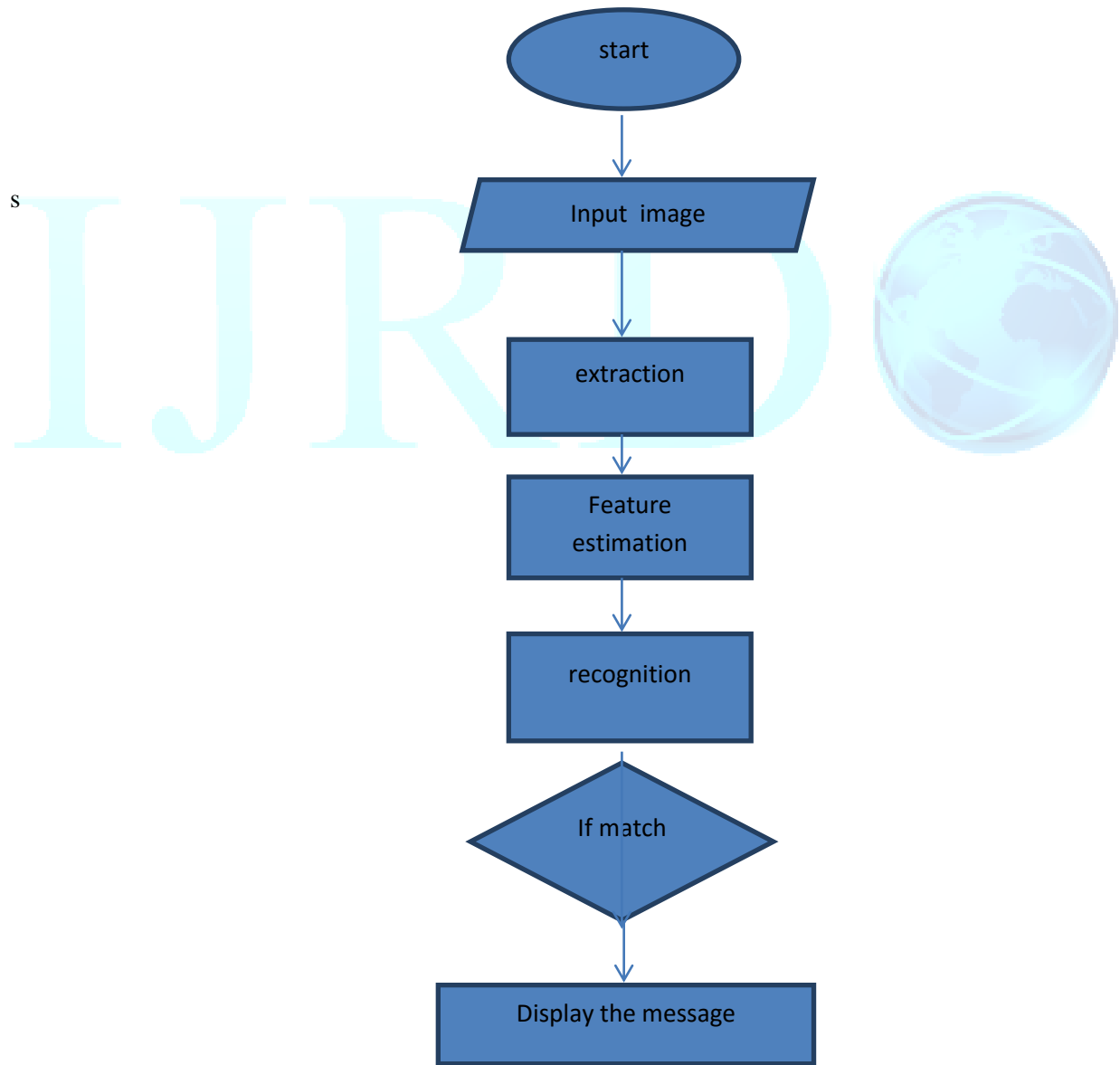

Figure 4.Gesture recognition system steps.

3.C.a. Extraction Method and image pre-processing

Segmentation process is the first process for recognizing hand gestures. It is the process ofdividing the input image (in this case hand gesture image) into regions separated by boundaries [7]. The segmentation process depends on the type of gesture, if it is dynamic gesture then thehand gesture need to be located and tracked [4], if it is static gesture (posture) the input imagehave to be segmented only. The hand should be located firstly, generally a bounding box is used

to specify the depending on the skin color [3] and secondly, the hand have to be tracked, fortracking the hand there are two main approaches; either the video is divided into frames and each frame have to be processed alone, in this case the hand frame is treated as a posture and segmented [4], or using some tracking information such as shape, skin color using some tools such as Kalmanfilter[4]. The common helpful cue used for segmenting the hand is the skin color [4], since it is easy and invariant to scale, translation, and rotation changes [000]. Different tools and methods used skin and non-skin pixels to model the hand. These methods are parametric and non-parametrictechniques, Gaussian Model (GM) and Gaussian Mixture Model (GMM) are parametric techniques, and histogram based techniques are non- parametric. However it is affected with illumination condition changes abs different races [5].

Some researches overcome this problem using data glove and colored markers which provide exact information about the orientation and position of palm and fingers [4]. Others used infrared camera [5], and range information generated by special camera Time-of-Flight (ToF) camera [4], although these systems can detect different skin colors under cluttered background but it is affected with changing in temperature degrees besides their expensive cost [5]. The segmentation considered as an open issue problem itself [8]. The color space used in a specific application plays an essential role in the success of segmentation process, however color spaces are sensitive to lighting changes, for this reason, researches tend to use chrominance components only and neglect the luminance components such as r-g, and HS color spaces. However there are some factors that obstacle the segmentation process which is [4]; complex background, illumination changes, low video quality. [5][6] applied HSV color model which concentrates on the pigments of the pixel, [12] used YCbCr color space. [5] used normalized r-g color space. Some preprocessing operations are applied such as subtraction, edge detection, and normalization to enhance the segmented hand image [8][6]. Figure 2 shows some segmentation method examples.

3.C.b Features Extraction

Good segmentation process leads to perfect features extraction process and the latter play an important role in a successful recognition process [5]. Features vector of the segmented image can be extracted in different ways according to particular application. Various methods have been International Journal of Artificial Intelligence & Applications (IJAIA), Vol.3, No.4, July 2012 applied for representing the features can be extracted. Some methods used the shape of the hand such as hand contour and silhouette [5] while others utilized fingertips position, palm center, etc. [5] created 13 parameters as a feature vector, the first parameters represents the ratio aspect of the bounding box of the hand and the rest 12 parameters are mean values of brightness pixels in the image. [12] used Self-Growing and Self-Organized Neural Gas (SGONG) neural algorithm to capture the shape of the hand, then three features are obtained; Palm region, Palm center, and Hand slope. [5] calculated the Center Of Gravity (COG) of the segmented hand and

the distance from the COG to the farthest point in the fingers, and extracted one binary signal (1D) to estimate\ the number of fingers in the hand region. [6] divided the segmented image into different blocks size and each block represents the brightness measurements in the image. Many experiments were applied to decide the right block size that can achieve good recognition rate [6][7][8] used Gaussian pdf to extract geometric central moment as local and global features.

3.C.c. Gestures Classification

After modeling and analysis of the input hand image, gesture classification method is used torecognize the gesture. Recognition process affected with the proper selection of features parameters and suitable classification algorithm . For example edge detection or contouroperatorscannot be used for gesture recognition since many hand postures are generated andcould produce misclassification . Euclidean distance metric used to classify the gestures. Statistical tools used for gesture classification, HMM tool has shown its ability to recognize dynamic gestures [9][11]besides, Finite State Machine (FSM) , Learning Vector Quantization [10], and Principal Component Analysis (PCA). Neural network has been swidely applied in the field of extracted the hand shape , and for hand gesture recognition.

4. APLICATION

☐ Hand gesture controlled robot for physically challenged.
☐ Hand gesture controlled doors and vehicles.
☐ Hand gesture controlled keyboard and mouse to interact with computer.
☐ Gesture controlled appliances like air conditioner.

5. CONCLUSION

This paper presented a technique to find the number of fingers present in the hand gesture. They are used in numerous applications. The further research studies are going on about this topic to obtain the necessary requirement.

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