Sign Language Recognition System (SLRS)

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Abstract— Deaf and dumb people use sign language for their communication but it was difficult to understand by the normal people. The aim of this paper is to reduce the barrier between in them. Gesture recognition helps to understand the meaning of human body movement that is movement of parts, which involves the movement of hand, head, arms, face or body. In this paper present a Sign Language Recognition System (SLRS) developed using image processing technique [1]. In this paper, using the webcam record the hand gestures and this video input is given to the system. In next phase, using the methods for extract the frames from video, next detect the gesture in the frames and process the gesture detected and next stage recognize the gesture and finally display the output in text and speech [1].

Key words: SLRS, Image Processing, Gesture Recognition, Sign Language

I. INTRODUCTION

Sign language is an expressive and natural language for communication between a disabled people and normal persons. Sign language relies on sign patterns, i.e., body language, orientation and movements of the arm to facilitate understanding between people. Deaf and dumb people use sign language for their communication but it was difficult to understand by the normal people. The aim of this paper work is to translate the sign language gestures into speech, text and to make easy contact with the dumb people and reduce the barrier between in them [2].

Gesture recognition is becoming an increasingly important for many applications such as human machine interfaces, security, and communication, multimedia. It provides a platform to express thoughts without speech. The powerful resource of communications among humans is hand gesture recognition. It provides a separate balancing modality to speech for expressing one's ideas. By using hand gestures for communication, a more natural interaction between humans and computing devices became so flexible and convenient for human being [3].

Research in the sign language system has two well known approaches are Image processing and Data glove technique. In image processing technique use the web camera to capture the image/video. Analysis the captured gestures and recognizes the gestures using algorithms and produce the output [3].

The existing data glove technologies for sign to text processing uses specialized sensors or may require the usage of gloves, optical markers based on IR reflection and skin color is considered for image processing hence affected by illumination. These are expensive and/or cumbersome. The solution proposed does not require the user to have any specialized sensors attached to his hand or wear any special gloves [4].

II. PROPOSED SYSTEM

The proposed sign language recognition system developed using image processing technique. In Proposed system user will provide the video as an input to the system. Video captured using web camera. Using frame grabber method we extract the frames. In next step, each extracted frames is processed individually, we detect the gestures in the each frames by skin color detection (Ycbcr) method. We extract the features of gestures by using contours and drawing the convex hull drawing on hand gestures and get the values like start point, depth point and end points (X, Y and Z) values. Using the extracted features of the hand gestures we recognition the hand gestures meaning (pattern). Finally, translate the recognized gestures into text and speech displayed as output of SLR system.

Fig.1. shows the flow diagram of proposed system. It provides flow of events from module to module. First provide video inputs frames are extracted and gesture detected, feature of gesture are extracted and recognize gesture are translate to speech and text.

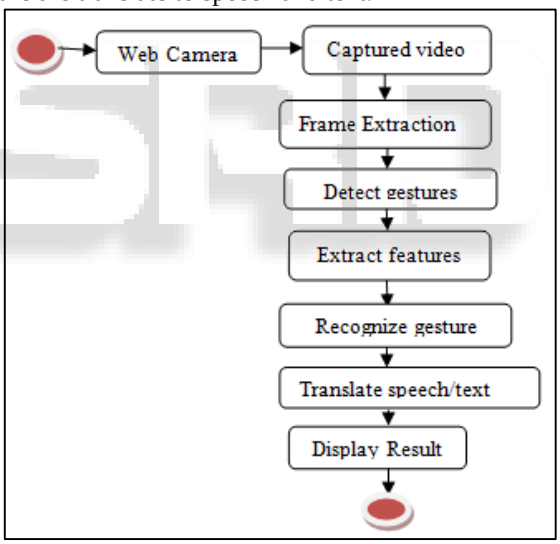

Fig.1: Flow diagram of SLR system

III. METHODOLOGY

a) Image processing: It is a processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Image processing usually refers to digital image processing, but optical and analog image processing also are possible [4].

b) Matlab: MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and fourth-generation programming language.

A proprietary programming language developed by Math Works, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, Fortran and Python[5].

c) .Net: The .NET Framework is an integral Windows component that supports building and running the next generation of applications and XML Web services. The key components of the .NET Framework are the common language runtime and the .NET Framework class library. The .NET Framework provides a managed execution environment, simplified development and deployment, and integration with a wide variety of programming languages [6].

d) C#:**C#** is a multiparadigm programming language encompassing strongtyping, imperative, declarative, functional, generic, object-oriented And component oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved as a standard by Ecma and ISO. C# is one of the programming languages designed for the Common Language Infrastructure. C# is intended to be a simple, modern, general-purpose, object-oriented programming language [5].

IV. IMPLEMENTATION

The proposed system has been design in such a way that some of the code are written in the matlab and codes written matlab are converted into .m files to .dll files using deploy tool options in Matlab and give this .dll files as reference in Visual studio. The classes of matlab which are used in visual studio are Support Vector Machine, Principal component analysis, K-nearest neighbor and probability skin module, normalize method. After giving reference in visual studio the user will debug the project and the system will ask the user to browse and give the video as input to the system. The system will take video as input and process it and shows the output. The modules of the proposed system are explained below.

a) Input: In the input stage, user will record a video using web camera. That contains the hand gestures and provides this video as input to the SLR system. Fig.2. shows the webcam attached to the system to provide the video of hand gestures.

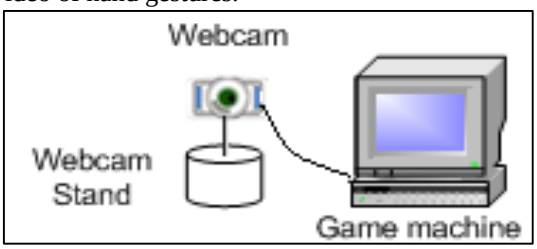

Fig. 2: System with web camera

b) Process: After getting the video input from the user, system will process the video step by steps. The video will go through the following stages.

a) Frame extraction: The recorded videos have to be pre-processed. First the videos are converted into frames, using the frame grabber method we extract the frames from the video.

b) Hand detection: In hand segmentation where the image region that contains the hand has to be located. In order to make this process it is possible to use shapes, but they vary greatly during the natural motion of hand. Therefore, we choose skin-color as the hand feature. The skin-color is a distinctive cue of hands and it is invariant to scale and rotation. The hand must be localized in the image and segmented from the background before recognition. Color is the selected cue because of its computational simplicity, its invariant properties regarding to the hand shape configurations and due to the human skin-colour characteristic values.

Along with this, the YCbCr based skin color model has also been employed. Skin color segmentation is performed in YCbCr color space since it reduces the effect of uneven illumination in an image. YCbCr is an encoded nonlinear RGB signal with simple transformation; explicit separation of luminance and chrominance components makes YCbCr was developed as part of the ITU-R Recommendation B.T. 601 for digital video standards and television transmissions. It is a scaled and offset version of the Y UV color space. In YCbCr, the RGB components are separated into luminance (Y), chrominance blue (Cb) and chrominance red (Cr). The Y component has 220 levels ranging from 16 to 235, while the Cb, Cr components have 225 levels ranging from 16 to 240. In contrast to RGB, the YCbCr color space is luma-independent, resulting in a better performance [5].

c) Feature extraction: After detecting the hand gesture in the frame and converted into binary gray scale image. To identify the gesture, need to extract the features of the gestures. Fig.3. shows the using skin-color-based contour method and convex hull drawing method. Using the above two methods, we plot the points and join those points and we get the three values start point, depth point and end point. For next stage we provide these three values as input. For this phase, we also using the PCA (principal component algorithm) gave as reference [5].

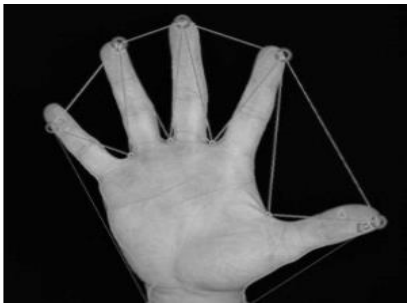

Fig. 3: Contours of hand

d) Recognition of gesture: In next phase, using the values of extracted features of gestures. System will recognize the gestures. In this phase, we also using Knn (k nearest neighbor) algorithm to recognize the correct gestures. Here we are not using any database, instead of that we dynamically recognizing the gestures based on the nearest values that obtain from the previous phase.

c) Output: After recognize the gesture from video frames, the recognized gestures meaning is provided as output

of the SLR system. The output will display in text and speech. Whenever the system recognizes the particular gestures the corresponding text and speech of the gestures displayed.

V. RESULT

In this section, proposed system outputs are provided. Fig.4. show the sign gesture "together" and their knn value and corresponding text.

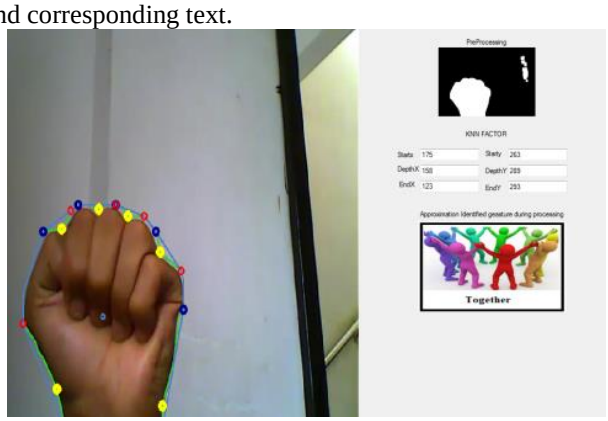

Fig. 4: Shows the Gesture "Together"

Fig.5. Show the sign gesture "stop" and their knn value and corresponding text.

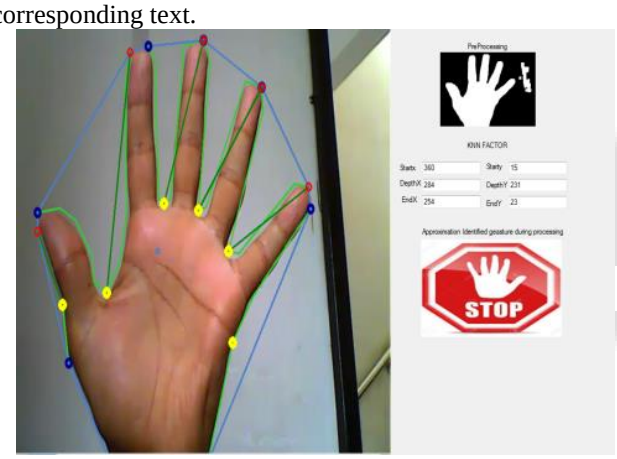

Fig. 5: shows the gesture "stop"

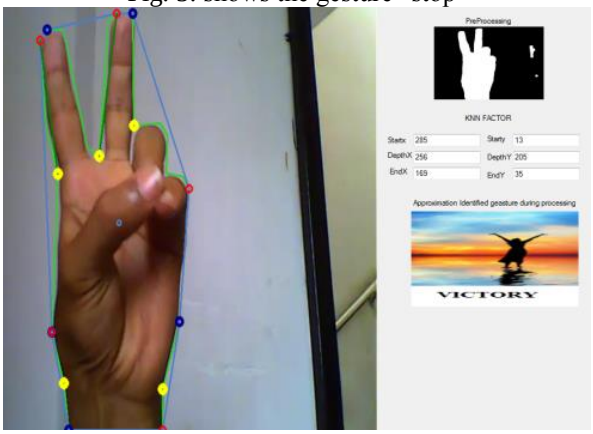

Fig. 5: shows the gesture "victory"

Fig.6. Show the sign gesture "victory" and their knn value and corresponding text. Knn values of each hand gestures are showed using three parameters start and depth and end points and each points values are showing using x and y value pairs. When the corresponding knn factor values are matched with hand gesture then their corresponding text and speech is displayed.

VI. CONCLUSION

The proposed Sign language recognition (SLRS) system translates sign gestures into text and speech automatically and satisfies them by conveying thoughts on their own. The proposed system overcomes the real time difficulties of dumb people and improves their lifestyle. The proposed system is developed using image processing technique. SLR systems take video input, extract the frames and detect the hand gesture and recognize gesture and displays the results in text and speech efficiently. The proposed system is more reliable and flexible, portable system. Which manufacture at low cost sign gesture translator for commercial use.

VII. FUTURE ENHANCEMENT

In future work, we enhance the functionality of the proposed system and supports more number of sign gestures (numbers, letters, words, sentences) and Different language mode (local languages) and develop an mobile application.

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