IOT Based Hand Gesture Sign to Speech Conversion System for Mute People

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Abstract

It's very difficult for mute people to convey their message to regular people. Since regular people are not trained on hand sign language, the communication becomes very difficult. In emergency or other times when a mute person travelling or among new people communication with nearby people or conveying a message becomes very difficult. So here we have designed a system which would enable the mute people to communicate with regular people. In this system webcam is placed in front of mute person. The mute person would put finger in front of web camera and webcam will capture the hand gesture and perform image processing. And hand gestures will be converted into voice for mute people and also message will be displayed on screen.

***Keywords** - sign language, voice conversion ,gesture to speech, hand gesture, dumb*

I. INTRODUCTION

The main objective of this project is to help mute people to communicate with regular people. In our country around 2.78% of peoples are not able to speak (mute). Their communications with others are only using the motion of their hands and expressions. Dumb people can’t speak and normal people don’t know the sign language which is used for intercommunication between mute people. This system will be useful to solve this problem. Gestures are in line with people's habits of communication, so many researchers have done a lot of work in gesture recognition based on vision based approach.

Here we propose a smart speaking system that helps mute people in conveying their message to regular people using hand motions and gestures. Need for the new system mute people can’t speak and normal people don’t know the sign language which is used for inter-communication between mute people. This system will be useful to solve this problem Advances/additions/updating the previous system Smart wearable hand device as a sign interpretation system using a built-in SVM classifier is implemented but the system is for blind people we here created a system for mute people too.

II. RELATEDWORK

In [1], authors successfully designed and implemented a novel and smart wearable hand device as a sign interpretation system using a built-in SVM classifier. An Android-based mobile application was developed to demonstrate the usability of the proposed smart wearable device with an available

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text-to-speech service.Jian Wu and Lu Sun [2] proposed a wearable real-time American Sign Language recognition system in their paper. Feature selection is performed to select the best subset of features from a large number of well-established features and four popular classification algorithms are investigated for our system design. The prototype architecture of the application comprises of a central computational module that applies the camshift technique for tracking of hands and its gestures. Haar like technique has been utilized as a classifier that is creditworthy for locating hand position and classifying gesture. The virtual objects are produced using Open GL library. [3]n [4], hand tracking based virtual mouse application has been developed and implemented using a webcam. The system has been implemented in MATLAB environment using MATLAB Image Processing Toolbox. The system can recognize and track the hand movement and can replace the mouse function to move the mouse cursor and the mouse click function. In general, the system can detect and track the hand movement so that it can be used as user interface in real time. YellapuMadhuri and et al [5] presents a report on a mobile Vision-Based Sign Language Translation Device for automatic translation of Indian sign language into speech in English to assist the hearing and/or speech impaired people to communicate with hearing people. This system is an interactive application program developed using LABVIEW software and incorporated into a mobile phone. This is able to recognize one handed sign representations of alphabets (A-Z) and numbers (0-9).

III. PROPOSED SYSTEM

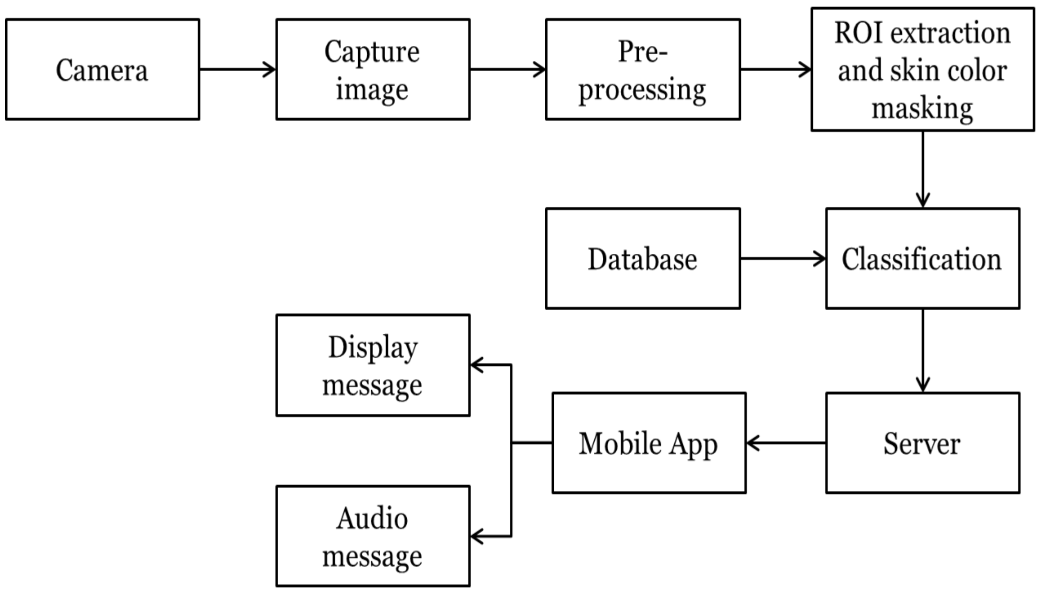

Fig.1 Block diagram of IOT based hand gesture sign to speech conversion system for mute people

First of all camera captures image of hand. Pre-processing: aim of pre-processing is to de-noise the image and subtract background from image. ROI (Region of Interest) extraction: as the name suggest

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extracting only that part of image which is of our interest or which has meaningful information. Database: it consists of different hand gestures and against them is user defined readable word/sentences. Classification: classifying hand gesture into readable and understandable sentences/words. Classifier compares input hand gesture with hand gesture present in database and accordingly classifies it into sentence. Classified sentence is then sent to server (firebase server). Android App fetches this sentence from server and then displays it onto app. App also plays audio of sentences for better results.

IV. SVM ALGORITHM

Support vector machines (SVMs) are powerful yet flexible supervised machine learning algorithms which are used both for classification and regression. But generally, they are used in classification problems. In 1960s, SVMs were first introduced but later they got refined in 1990. SVMs have their unique way of implementation as compared machine learning algorithms. Lately, they are extremely popular because of their ability to handle multiple continuous and categorical variables. An SVM model is basically a representation of different classes in a hyperplane in multidimensional space. The hyperplane will be generated in an iterative manner by SVM so that the error can be minimized. The goal of SVM is to divide the datasets into classes to find a maximum marginal hyperplane (MMH).

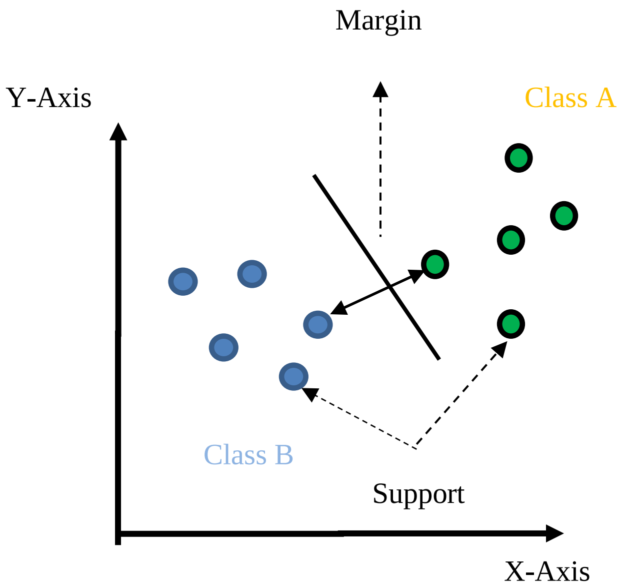

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Fig. 2 Support Vector Machine (SVM) diagram

The followings are important concepts in SVM −

A. *Support Vectors*-

Data points that are closest to the hyperplane is called support vectors. Separating line will be defined with the help of these data points.

B. *Hyperplane* -

As we can see in the above diagram, it is a decision plane or space which is divided between a set of objects having different classes.

C. *Margin* –

It may be defined as the gap between two lines on the closet data points of different classes. It can be calculated as the perpendicular distance from the line to the support vectors. Large margin is considered as a good margin and small margin is considered as a bad margin.

The main goal of SVM is to divide the datasets into classes to find a maximum marginal hyperplane (MMH) and it can be done in the following two steps −

- First, SVM will generate hyperplanes iteratively that segregates the classes in best way.
- Then, it will choose the hyperplane that separates the classes correctly.

In practice, SVM algorithm is implemented with kernel that transforms an input data space into the required form. In simple words, kernel converts non-separable problems into separable problems by adding more dimensions to it. It makes SVM more powerful, flexible and accurate.

The following are some of the types of kernels used by SVM.

1. **Linear Kernel** - It can be used as a dot product between any two observations. The formula of linear kernel is as below –

$$K(x, x_i) = sum(x * x_i) \qquad (1)$$

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From the above formula, we can see that the product between two vectors say $x\&xi$ is the sum of the multiplication of each pair of input values.

2. **Polynomial Kernel -** It is more generalized form of linear kernel and distinguish curved or nonlinear input space.
   Following is the formula of polynomial kernel -
   $k(X,\ X_i) = 1 + sum(X * X_i)^d$……………………………………..(2)

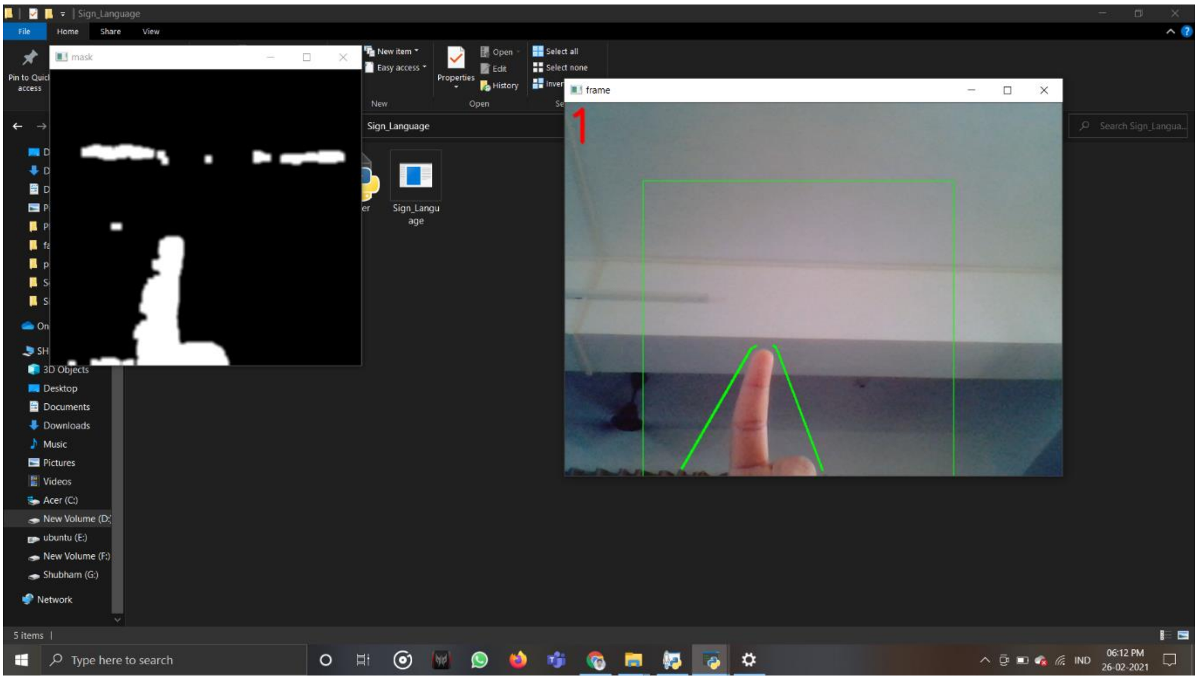
Here d is the degree of polynomial, which we need to specify manually in the learning algorithm.

3. **Radial Basis Function (RBF) Kernel** - RBF kernel, mostly used in SVM classification, maps input space in indefinite dimensional space. Following is the formula of explains it mathematically -

$$K(x,\ x_i) = \exp(-gamma * sum(x - x_i^2)) \quad …………………………(3)$$

Here, gamma ranges from 0 to 1. We need to manually specify it in the learning algorithm. A good default value of gamma Is 0.1. As we implemented SVM for linearly separable data, we can implement it in python for the data that is not linearly Separable.

V. RESULT 1



RESULT 2

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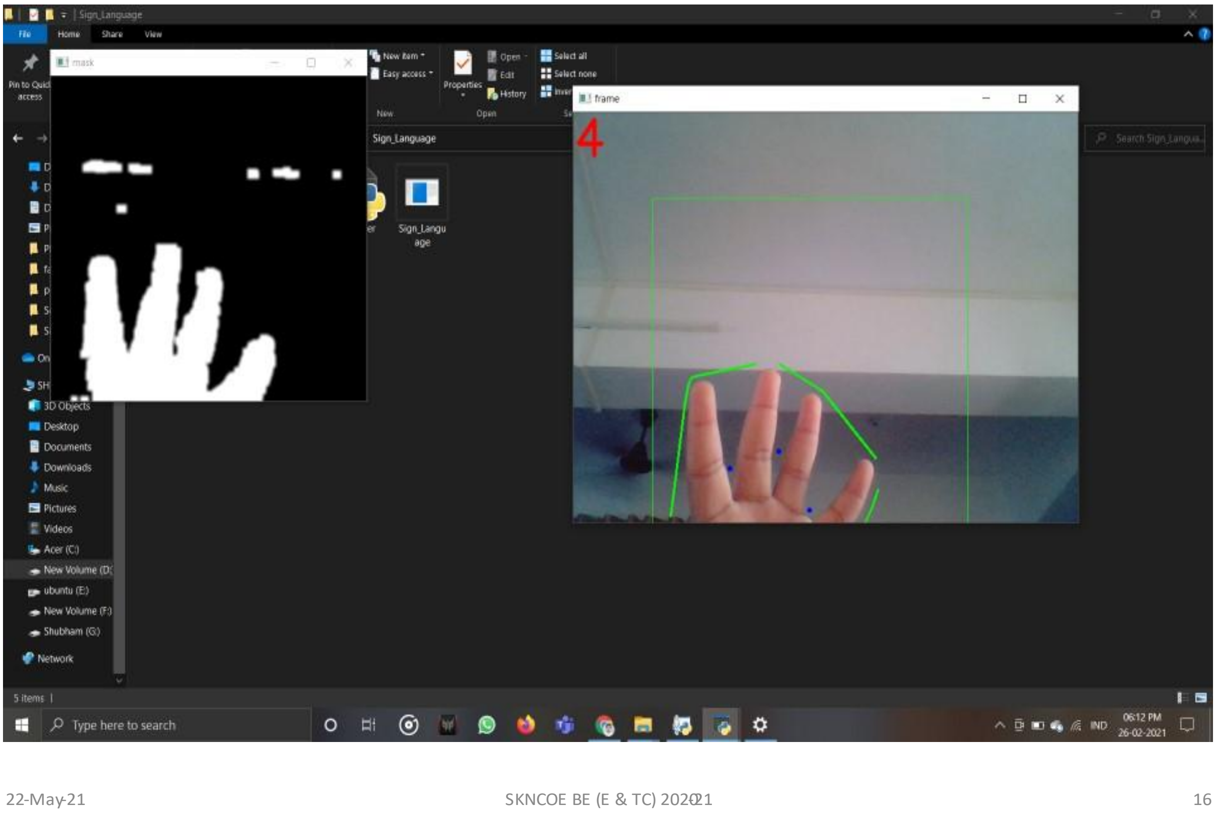

RESULT 3

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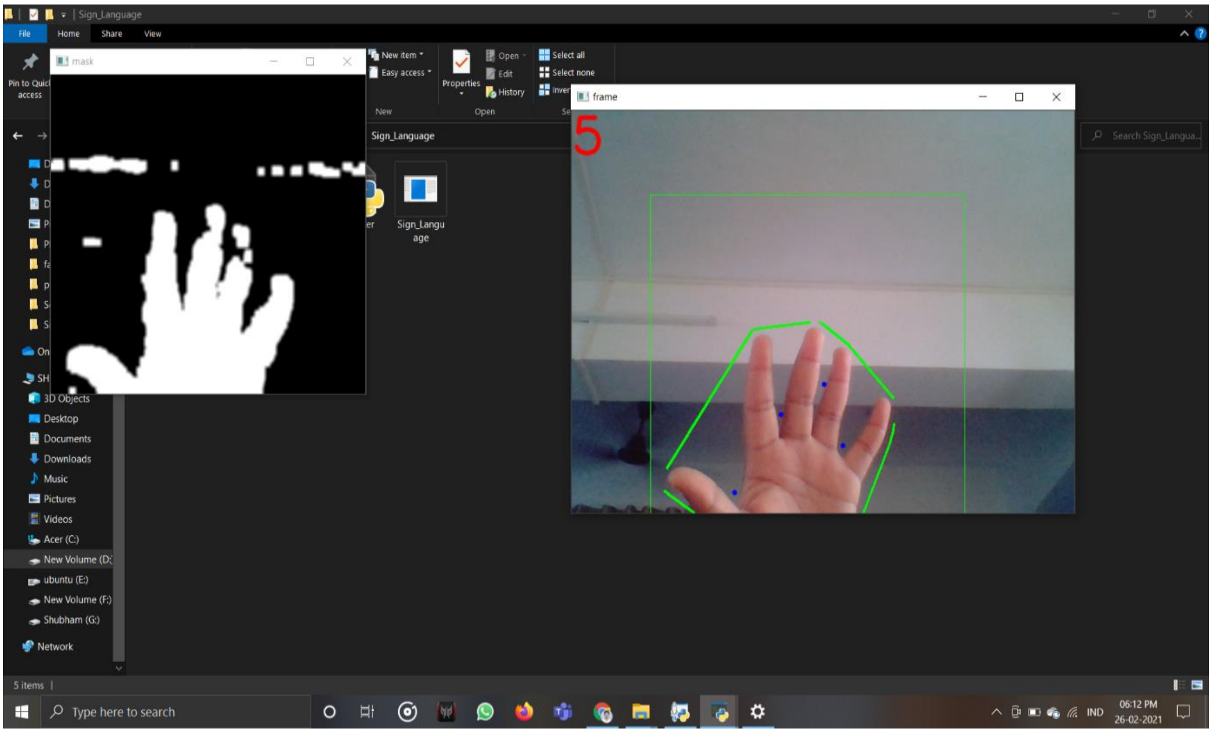

VI. CONCLUSION

This system eliminates the barrier in communication between the mute community and the normal people. It also provides communication between dumb and blind. It is also useful for speech impaired and paralysed patient means those do not speak properly. The project proposes a translational device for deaf-mute people using glove technology. Further the device will be an apt tool for deaf mute community to learn gesture and words easily. And also it is portable.

VII. REFEENCES

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