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An IOT Integrated Gesture Recognition Using Image Processing For Speech Impaired People

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ABSTRACT

The gesture is one of the most powerful and dramatic ways of communications between human and computer. The method proposed here gives a real-time gesture recognition system for speech impaired people to reduce the communication gap between the mute community and additionally the standard world. The proposed approach is capable of detecting gestures with good accuracy. The gestures shown in front of the system inbuilt camera is used for image processing. The Horn Schunck optical flow algorithm is used to track movements in the video frames. Gesture library is created by subdividing the data frames. Here hand movements are focused. For each gesture shown corresponding text and speech output is generated in MATLAB. The generated result is used for website update in VB (Visual Basic).The Python language is used for IoT integration, here the MATLAB and VB are connected via python. The VB provides text and speech output along with the website generated. The speech and the text output for the corresponding hand gestures shown can be accessed on any device by sharing the VB created and by providing the corresponding IP address of the source device. The matching score over multiple instances of training and testing is around 98%in MATLAB and VB gives 100% accuracy. This system is portable for the disabled to carry with them at their convenience. The basic objective of this project is to develop a computer-based intelligent system that will enable speech impaired people significantly to communicate with all other people using their natural hand gestures.

Keyword: Horn–Schunck Method, HCI, Image Processing, Python, Visual Basic, and Gestures.

1. INTRODUCTION

Witnessing a technical revolution in everyday life and living in the privileged galaxy of intellects it is imperative not to overlook the responsibility to utilize technology in order to contribute to the development and progress of the society. Communication is the fundamental basis for any individual, it is a skill to live a normal life. A person who is dumb or whose speech is not understood by a listener is considered to have a speech disability. A person with speech disorders who is unable to speak is considered as mute. Mostly candidates who are hearing impaired are also speech impaired.

Sign Language is a non-verbal method of communication in which gestures are made by hands. Gestures are an integral part of our day to day communication and some expressions are conveyed by gestures only. Rising of eyebrows, shrugging of shoulders, nodding heads are some commonly used gestures. Sign language is a more organized form than gestures. Various commonly used sign languages are ASL (American Sign Language), BSL (British Sign Language) and ISL (Indian Sign Language). There is no one standard form of sign language and it varies from region to region. Humans know each other by conveying their ideas, thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one among all is

the gift of "Speech". Through speech, everyone can very convincingly transfer their thoughts and understand each other. [4]

IoT is expected to offer advanced connectivity of devices, systems, and services that go beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects) [5]. Creates an ecosystem for connected physical objects that are accthrough the internet.

1.1 OBJECTIVE

To design and set up a system for speech impaired people to lower the communication gap between the mute community and additionally the standard world

1.2 SCOPE

This project focus to reduce the communication gap within the speech impaired people. Common people can easily communicate with the mute community without the knowledge of sign language. Human translators can be replaced with this system. This system is portable for the disabled to carry with them at their convenience**.**

2. LITERATURE SURVEY

It is difficult to settle on a specific definition of gestures due to its large variety of applications and a statement can only specify a particular domain of gestures. Many researchers had tried to define gestures but their actual meaning is still arbitrary. The gesture is defined as an expressive movement of body parts which has a particular message, to be communicated precisely between a sender and a receiver. A gesture is scientifically categorized into two distinctive categories they are dynamic and static gestures. A static gesture is observed at the spurt of time whereas dynamic gesture is intended to change over a period of time. A stop sign is an example of static gesture and the waving hand means goodbye is an example of dynamic gesture. To understand a full message, it is necessary to interpret all the dynamic and static over a period of time. This complex process is called gesture recognition. The process of recognizing and interpreting a stream continuous sequential gesture from the given set of input data is Gesture recognition.

Speech disorders or speech impediments are a type of communication disorder where 'normal' speech is disrupted [9]. The richest source of communication between the people is hand. Speech impaired people uses sign languages to interact with others. To reduce the communication gap between speeches impaired people and normal people the survey was carried out.

2.1 HAND GESTURE RECOGNITION

The essential aim of building hand gesture recognition system is to create a natural interaction between human and computer where the recognized gestures can be used for conveying meaningful information [7].Human-computer interaction (HCI) also named Man-Machine Interaction (MMI) [8] [9] refers to the relation between the human and the computer or more precisely the machine, and since the machine is insignificant without suitable utilize by the human [8]. There are two main characteristics that should be deemed when designing an HCI system [8] they are functionality and usability. System functionality referred to the set of functions or services that the system equips to the users [8], while system usability referred to the level and scope that the system can operate and perform specific user purposes efficiently [8]. The system that attains a suitable balance between these concepts considered as influential performance and powerful system [8]. Gestures used for communicating between human and machines as well as between people using sign language [10]. Gestures can be static (posture or certain pose) which require less computational complexity [11] or dynamic (sequence of postures) which are more complex but suitable for real-time environments [11] [12]. Different methods have been proposed for acquiring information necessary for recognition gestures system [13][14]. Some methods used additional hardware devices such as data glove devices and color markers to easily extract a comprehensive description of gesture features [13]. Other methods based on the appearance of the hand using the skin color to segment the hand and extract necessary features [13]. Some recent reviews explained gesture recognition system applications and its growing importance in our life [15] especially for Human-computer Interaction HCI, Robot control, games, and surveillance, using different tools and algorithms [14].

2.2 PHYSICAL SITE VISIT

During the first phase of the project, a survey was conducted at 'GOVT VOCATIONAL HIGHER SECONDARY SCHOOL' located in the area Ottapalam, Palakkad district of KERALA state. The Principal and teachers of the school gave an idea about their teaching methodologies, mindset and special requirements of the disabled students. They also mentioned about the problems faced by the students during communication. The changes in the students were noted as well as the major problems that were faced by the teachers in teaching the

students with special needs came across clearly. It was challenging to communicate with the children directly. The information about the children who can afford to buy and use gadgets was discussed with the principal. The children are more comfortable communicating via sign language. The two mute children can communicate more easily and quickly than with the teachers. The children also focus on lip reading but they are more comfortable with gestures. The principal also mentioned that the hearing and speech impaired children's are slow learners so that the government offers some gadgets for their quick learning. While interacting with the teachers they mentioned that the sign language varies from region to region even though there are some standard sign languages

2.3 SOME EXISTING RESEARCH SOLUTIONS

Deaf speech assessment using digital processing technique [37] is an important contribution that auditory science can make to identify what features of the speech stimuli are relevant and what underlying time-frequency analysis strategies should be undertaken in order to extract them. Such features would then form the front end of a speech recognition system, or determine the structure of a speech coder. Computer-Aided Interpreter for Hearing and Speech Impaired [38] a system to enhance the quality of communication for hearing and speech impaired people. It seeks to establish a two-way communication by means of Human-Computer Interaction (HCI) and Computer-Human Interaction (CHI). This performs two basic processes that are, recognizing the input voice signal and displaying the corresponding pictorial representation of the sign language gesture, and capturing the hand gesture and producing the corresponding voice output. This is achieved using Natural Voice Processing and Digital Image Processing algorithms. A camera and a microphone become the prerequisites for the system to convert voice into gestures and gestures to voice. Automated speech synthesizer and converter in cue symbol generation for hearing impaired [39] mainly emphasizes on conversion from normal person to hearing impaired i.e. voice to sign language. It would still be difficult for the hearing impaired person to express his thoughts. Apart from all these techniques, Google play store provides various apps that attempted to solve the problems faced by mute people but none of them provided a complete solution to the problems. Applications that convert text to speech, text, and audio to sign, sign language interpreters and standard signs guides to name a few are available but none of them work properly to reduce the communication barrier. There is no integration of all the features required for a conversation in one single application.

3. MODELLING

The proposed system in which the first and the basic process is image acquisition. To capture hand gestures an integrated or external web camera can be used. Here an inbuilt camera is used to capture the real-time video by initializing the camera parameters. A database is created by converting this real-time video into frames. The image is captured using the image processing toolbox in the MATLAB with a frame grab interval. The database created can be subdivided to create libraries for each gesture. From the database created feature is extracted from each frame. Horn- Schunck optical flow method is used for this purpose. Optical flow is used to compute the motion of the pixels of an image sequence. After creating a database and extracting its feature. Test frames are generated. Test frames are also created by showing gestures in front of the inbuilt camera in the system thereby which the real time video is captured and converted to frames by taking snapshots per interval. Feature extraction is carried out and feature matrix will be generated .this feature matrix is added to the feature matrix obtained from the database. With the help of Euclidian distance equation, matching is tested between the testing features and database features and matching score is obtained. From the matching score, the minimum value is chosen to form a recognized matrix. The recognized matrix provides the text and speech output in MATLAB i.e. for the signs shown corresponding text and speech is produced by taking the minimum value of the matching score. This text is saved in a separate notepad created for IoT integration the Python language is used to integrate both the matlab and visual basic. The output of the matlab text is accessed by VB.VB is programmed in such a way that it generates corresponding sound and text output in the website created

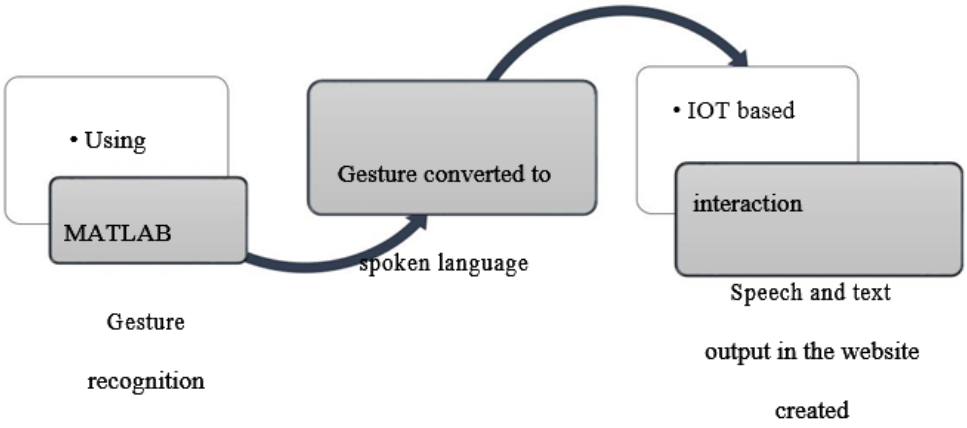

Fig -1: Basic model of the proposed system

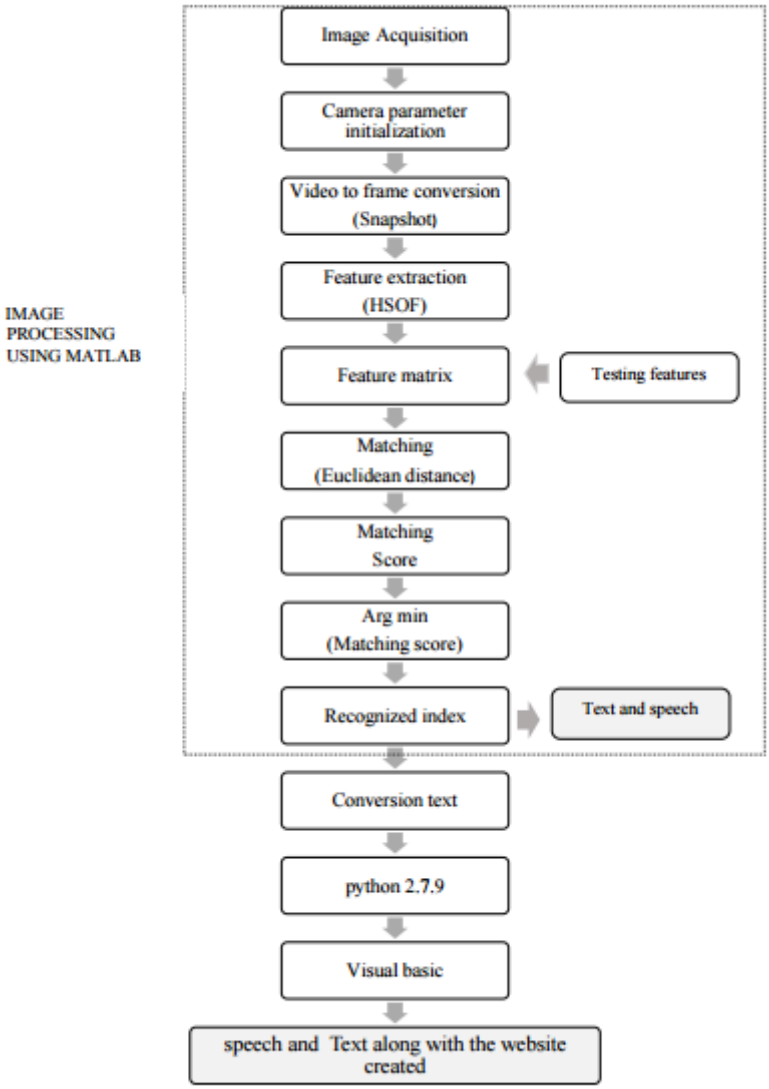

Fig -2: System modelling

4. CONCLUSIONS

This work gives a real-time gesture recognition system for speech impaired people to lower the communication gap between the mute community and additionally the standard world. The proposed approach is capable of detecting gestures with good accuracy. The person showing gestures in front of the system inbuilt camera is used for image processing. From the real-time video snapshot is captured to process image processing via MATLAB. The database is generated first then feature is extracted. The Horn Schunck optical flow algorithm is used to track movements in the video frames. Here hand movements are focused. For experimentation of this model, a subset of Sign Language is used. A 3 test subjects were used first, they are "hi", "more" and "yes" then three more libraries were added " Hi, I am Divya", "My project topic is", "AN IoT INTEGRATED GESTURE RECOGNITION USING IMAGE

PROCESSING FOR SPEECH IMPAIRED PEOPLE". For each gesture shown corresponding text and speech output is generated in matlab. The generated result is used for website update in VB (Visual Bsic).The python language is used for IoT integration here. THE MATLAB and VB are connected via this language. The vb provides text and speech output along with the website generated. The word matching score over multiple instances of training and testing is 98%in MATLAB and VB is 100%. The output of this modeled system can be accessed in any devices which can accept a VB application by providing the corresponding IP address of the source device. This system is portable for the disabled to carry with them at their convenience. Future work will involve making the system more portable for the disabled to carry with them at their convenience. This can be achieved preferably by using the camera of mobile phones to get a sequence of images of hand gestures and then applying image processing techniques to get the gesture recognized. Another direction can be to combine the techniques of finger detection and gesture recognition for a complete system capable of detecting any type of gesture specifically those involving minor variations of fingers and its movements. It will be very useful to add a feature that does the converse process for all possible sign languages. The optimization of memory utilization, in this case, will be of important since there are many sign languages and each with its own dictionary Incorporating facial expression and video generation in the recipient device in the sign language can also be one of the important directions which need to be investigated in the future. Another direction in which this work can be extended is to evaluate its performance using a larger dictionary size having more gestures providing speech output in different languages and study its effect on the accuracy and speed along with background disturbances.

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