Sign Language Recognition Using Leap Motion Controller

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Abstract—" **Sign language is the way through which deaf and dumb people can communicate with each other. It has been observed that impaired people find it very difficult to interact with the society. Normal person can't able to understand their sign language. This system Uses Leap Motion Controller to capture the signs. Thus the method is proposed for feature extraction of dynamic gesture of Indian sign language. This proposed method extract feature from the sign and convert to the intended textual form and also audio form. This integrated feature improves the performance of the system, the system serves as an aid to disable people. Our purpose is to design a Sign Language switch into Speech Translation system for ISL(Indian Sign Language) based on a 3 dimensional(3D) motion detector referred to as Leap Motion device. The leap motion device consists of three infrared sensors and two inbuilt cameras which is capture 3D images or hand gestures".**

Keywords— Gesture recognition, leap motion, deaf person, sign language.

I. INTRODUCTION

Humans have been provided by nature with the voice capability that allows them to interact and communicate with people. The spoken language become one of the main attributes of humanity. Unfortunately not everybody possess this capability due to the lack of sense, i.e hear or speak. Loss of hearing or speech can cause people to become isolated and lonely having a tremendous effect on both their social and working life. To reduce this gap between the normal people and the impaired people Sign language is introduced. Sign language is well structured code gesture language, every gesture has meaning assigned to it. This is the most important communication way between impaired community and normal person. It is observed that ordinary people does not understand sign language. So to overcome this problem and make the communication possible this system is introduced. As smart phones and tablet devices have been improved, voice input and voice recognition interfaces have been widely used. The advantage of voice input is faster as compared to keyboard or pad touch. So it is the minimal burden for ordinal users in particular for elder users who are not familiar with text input. However, the voice input and the voice recognition interfaces is extremely difficult for deaf people. Therefore, any interfaces which do not need voice input should be developed for those people.

A sign language is a kind of communication means for deaf people. There are also voice recognition systems that can convert spoken sound into written words but they do not understand what they are writing they only take dictation. Even these systems are shortly limited you must speak slowly and clearly. Artificial neural networks are computational models stimulated by animal central nervous systems that are able to perform of machine learning and pattern recognition. The Leap Motion Controller uses infrared (IR) imaging to conclude the position of predefined objects in a defined space in real time. The Leap software analyses the objects observed in the devices field. It recognizes hands, fingers, and tools, reporting discrete positions, gestures, and motion.

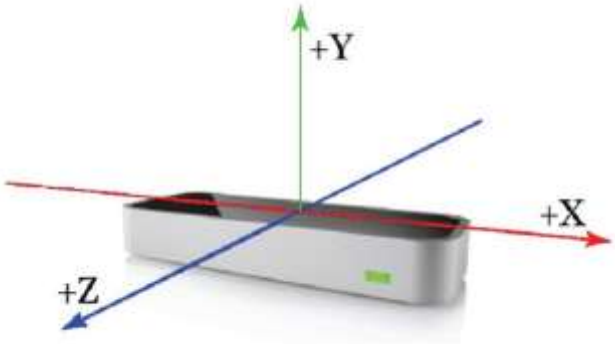

FIGURE 1: LEAP MOTION CONTROLLER

The leap motion controller is a device recently developed Leap Motion Company. It detects and tracks hands, fingers reporting discrete positions and motion. Leap Motion is modern sensor used to track user movements,it is regarded as the most easy to use and handy in everyday situations due to its small size and low cost.

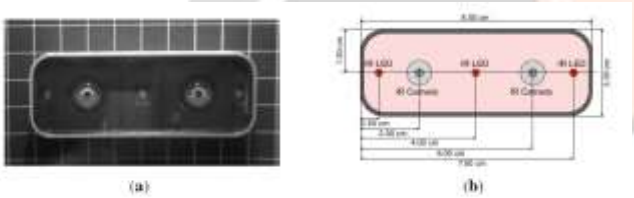

Figure 2: Real and schematic view of leap motion controller.

The Leap Motion controller in combination with the current API (Application Programmer Interface) convey positions in Cartesian space of predefined objects like finger tips, pen tip, etc. The delivered positions are relative to the Leap Motion controllers centre point, which is located at the position of the second, centred infrared emitter. the controller consists of three infrared (Infrared Light) emitters and two infrared cameras. Hence, the Leap Motion can be grouping into optical tracking systems based on Stereo Vision. Because of the missing point cloud of the scene and the predefined measurable objects, traditional arrangement techniques are not applicable for the Leap Motion. Nevertheless, a exact reference system is needed in order to evaluate the accuracy and repeat ability of the Leap Motion controller.

II. LITERATURE SURVEY

In this paper The system implements DTW combined with IS algorithm. This algorithm used for converting the hand gestures into text, supported by leap device. Leap device consists of inbuilt camera and two IR sensor. These camera and IR sensors used capture hand signals. The IS apply trigger when the present environment changes effectively, DTW manages gesture transformation mapped with similar patterns. NLP includes Natural Language Processing and Neural Networks. [1].

American Sign Language Recognition Using Leap Motion Sensor, In this paper American Sign Language recognition system using a compact and affordable 3D motion sensor. The palm-sized Leap Motion sensor provides a much more movable and moderate solution than Cybler glove or Microsoft kinect used in existing studies. Authors applied k-nearest neighbour and support vector machine to arrange the 26

letters of the English alphabet in American Sign Language using the derived features from the sensual data. The experiment result shows that the highest average classification rate of 72.78per. and 79.83per. was achieved by k-nearest neighbour and support vector machine respectively. Author also provide detailed discussions on the parameter setting in machine learning methods and accuracy of specific alphabet letters in this paper [2].

Arabic Sign Language Recognition Using Leap Motion Sensor, In this paper author proposed a new approach for Arabic Sign Language Recognition (ArSLR) which involves the device which is use the recently introduced Leap Motion Controller (LMC). This LMC device identify and tracks the hand and fingers to provide position and motion information. In addition to data, the system includes a classification stage, a feature extraction stage, a pre-processing stage and author compared the performance of Multi layer Perceptron (MLP) neural networks with the Nave Bayer classifier. Using the proposed system on the Arabic sign alphabets gives 98per. Classification accuracy with the Nave Bayer classifier and more than 99per. using the MLP [3].

Sign Language Recognition using Leap Motion Controller, in this paper author proposed a sign language recognition method using Leap Motion Controller. Sign language recognition algorithm is using 16 kinds of decisions. The constructed flowchart is differing as order of decisions, recognition rate for all letters change from the difference accuracy rate of decisions. For sorting of decisions is huge combination. The genetic algorithm is invoked to search for the optimal solution in the automatic construction of sign language recognition algorithm [4].

Sign language recognition had totally different sensors to capture hand gestures. Gloves digital cameras, Kinect and depth cameras were used instead in most systems. Our purpose is to design a Sign Language switch into Speech Translation system for ISL(Indian Sign Language) based on a 3 dimensional(3D) motion detector referred to as Leap Motion device. The leap motion device consists of three infrared sensors and two inbuilt cameras which is capture 3D images or hand gestures**.** The palm-sized Leap Motion sensor provides far more movable and moderate solution than Cyber glove or any existing studies. This sensor attempt the major problems in vision-based systems like skin colour, lighting etc... The system will use of DTW algorithm as a classifier to convert hand gestures into text and text into an audible speech [5].

III. PROPOSED SYSTEM

Sign language recognition system that uses leap motion to capture hands as input data. Figure 3.illustrates the leap motion interaction and its resulting data. The leap motion detects and tracks hands and fingers placed within its field of view and presents motion tracking data as a series of snapshots called frames. Each frame of tracking data contains the measured positions, orientations and other information about each entity detected in that snapshot. The Frame Data represents a set of hand and finger tracking data detected in a single frame. The most important data in the leap set of data is:

- **Hands**: An array of hands objects which contains the physical characteristics of a detected hand. Hand tracking data include a palm position and velocity; vectors for the palm normal and direction to the fingers; properties of a sphere to the hand; and lists of the attached fingers and tools.
- **Fingers**: An array of point able objects which contains the physical characteristics of a detected finger, such as direction and length of each finger.
- **Gestures**: An array of gesture objects which represents a recognized movement by the user and this movement could be a circle, swipe, screen Tap, or key Tap.

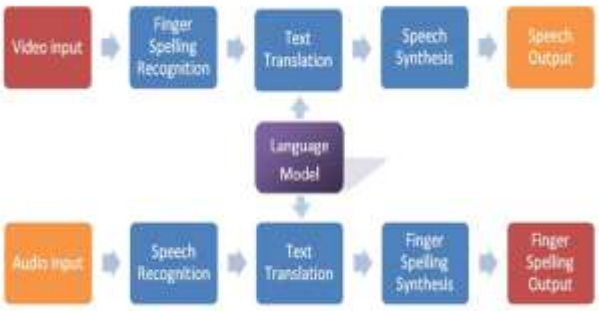

Figure 3: System Flowchart.

1. **Functional Requirements:**

- This feature will translate the recognized gesture into the textual meaning of the gesture and display the translated text to the user.

- System will recognize the appropriate movement of the hands and will search its database to match the movement with the pre-defined gestures. After matching system, will add the meaning of the sign to the opened file.

- Normal Flow of Events:

- User selects the communication mode from the main menu
- User opens a file
- User performs the movement
- Gesture is recognized and has a match
- The text is added to the file and displayed to the user and also speech out the words or sentence.

1. **Non-functional Requirements:**

- Performing ISL via Leap motion controller should be used by a single person. Our system should run on 32 bit (x86) or 64 bit (x64) Dual-core 2.66-GHZ or faster processor. It should not exceed 2 GB RAM.

- For the time being, we will use Leap motion controller to control the input stream and C programming language in the Visual Studio. Software architecture will be based on real time continuous gesture recognition methods.

Algorithms:

1. Rule Based Algorithm:

- The rule based system can be fashioned by stating a set of rules which states that how to act on assertion set. Rule based systems are properly simple model that can be modified to any number of problems.
- Rule base is specific type of knowledge based system. It is based on interaction with input gestures. The interpreter can execute production system program by using some rules.

- Rule based system uses a simple technique. It begins with a rule base, which consists of knowledge encoded in the form of if-then rules, and a working memory, in which initially may or may not consists of any data, assertions or initially known information.
- Rule based system contains various advantages such as natural knowledge representation, uniform structure.
- Ruled based algorithm is applied in for feature extraction. This algorithm introduces new measures for generating and optimizing rules. These new measures are calculated with respect to uncertain data interval and probability distribution function. Supported by the new measures, the best splitting attribute and splitting value can be identified and used for classification and reasoning.
- The algorithm takes out the rules one class at a time for a data set. Algorithm will extract the set of rules that shows the relationship between attributes of the dataset.
- Rule based algorithm is classification algorithm. In that, various classification techniques are used such as PART, Decision Tree, RIPPER, RIDOR.

2. KNN(K-Nearest Neighbor) Algorithm:

- K-Nearest Neighbor is nothing but the instance based learning algorithm. It is the part of supervised learning classifications in data mining, image processing, statistical pattern recognition system.
- K-Nearest Neighbor can find the closer element to each other. It has the very robust algorithm to noisy training data.
- This algorithm is designed to work as a first level detection The algorithm acts in a high performance execution which is exactly needed for such type of systems.
- The same method can be used for regression, by simply assigning the property value for the object to be the average of the values of its k nearest neighbor.
- It can be useful to weight the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones.

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