

Indian Sign Language Translator Using Kinect

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Abstract Though Indian sign language (ISL) translation remained under examination for numerous years, still it is very difficult to implement in real-time systems. The background and brightness disturb the skeleton tracing and make the ISL translation very hard. Microsoft Kinect Xbox 360 is capable of giving in-depth vision image and color vision image of everything in front of it, created on which the skeleton body action can be tracked more precise and easier to get depth coordinate of the skeleton. So that nearest matrix matching algorithm of each ISL word is coordinated and matched among input data to get the result.

Keywords Kinect · Sign language · SimpleOpenNI · Indian sign language translator · Sign language translator

1 Introduction

In this world many people live, while some of them are differently abled people, they cannot speak and hear. Also, they have different language to communicate with others, known as sign language.

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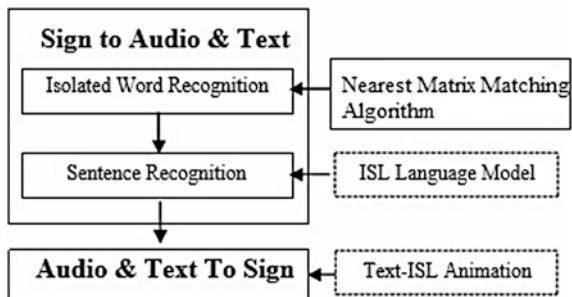
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Fig. 1 Kinect device

Fig. 2 Main functions of the demo system



Sign language is a vital communication way among differently abled people. Recently, sign language has been broadly planned to establish on many input devices, such as web camera, data glove, etc. [1, 2]. Though data glove-established ISL translator works better for huge numbers of signs, the data glove is too costly. With a web camera ISL translator, the main advantages are accurateness of the system and body movements. However, it is tough for backgrounds and brightness. On the flip side, ISL translator's goal is to implement good and precise ISL translation using the depth images value acquired by *Microsoft Kinect Xbox 360* Fig. 1.

The simple plan of the ISL translator system is specified in Fig. 2. The nearest matrix matching algorithm characterization comparable to the input ISL word coordinates is recognized by skeleton body tracing facility provide by Kinect software development kit [3]. While dealing with the variance of skeleton movement speed, a pattern matrix is completed to achieve the normalized input pattern matrix coordinates by balancing the acquired size of the entire matrix.

To achieve the final result, an adjustment among the input pattern matrix and storage pattern matrix are required. And finally, the matching results are figured out based on the maximum hit evolution to give the translation output (Fig. 3).

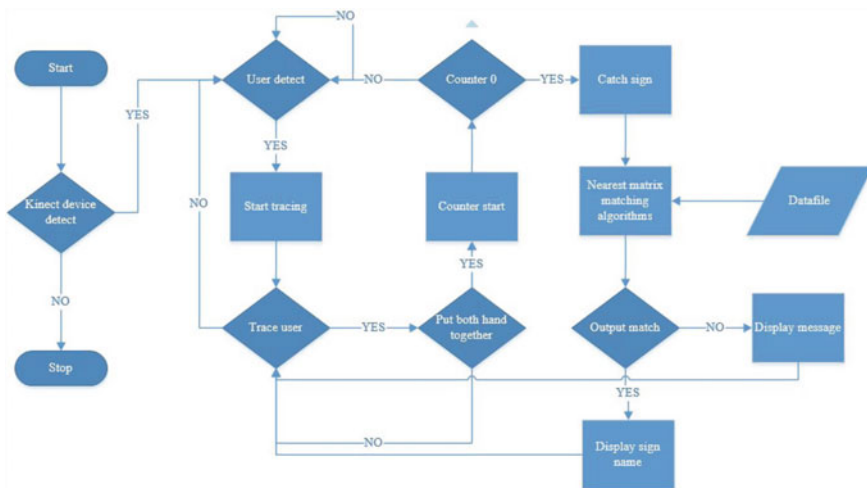


Fig. 3 Flowchart

2 Kinect

Indian sign language translator uses a hardware device called *Kinect for windows*. Kinect device was developed by Microsoft. Microsoft introduced Kinect on November 10, 2010 and is widely used in the Xbox.

Also Microsoft provides Kinect for developing commercial applications. It is a programmable device so that we can program it based on our requirement. Kinect gives x , y , and depth coordinate of 21 joints of human skeleton. Also it is responsible for tracing the human skeleton. Kinect can trace two skeletons at a time.

Through Kinect device we can catch sign, normalize it, and store the sign pattern to the data file. Also, find an input sign into appropriate word through applying *nearest matrix matching* algorithm on the data. Also, we have to use the *SimpleOpenNI 2.2* API of Java, which is responsible to connect Kinect in the system. Moreover, we use the *JavaFX* API for the media player and to play the video of the sign. We use *processing-2* tool for some graphics, and some processing data. For text to voice, we use *speech freetts 1.2.2* API of Java.

3 Proposed ISL Translator System

Our projected nearest matrix matching algorithm, an ISL translator system, is making a strong communication bridge for differently abled people and persons.

The ISL translator system contains two main modules: Sign to Text module, this module is used to translate sign language into text as well as speech and Text to

Sign module, this module is used for any person to communicate with a differently abled person via corresponding video.

Sign to Text module contains single-word translation and sentence translation. In sentence translation, all sign words of any sentence will be the input constantly and after that ISL system will provide the results by maximum hit count of all words of the sentence.

In the Text to Sign module, a video shows the matching ISL word or sentence for the text input by keyboard. The differently abled people give an instant replay via ISL translator. So the normal person can also communicate with the differently abled person.

3.1 Flowchart of System

System flow is once you start the application, it will check the necessity required for the system. When user skeleton is detected, then it will start to trace it. Now you have to put your hands together and wait until the counter reaches down to 0. Once it is completed, it will start to take input for 1.5 s sign.

Apply nearest matrix matching algorithm on that data and give appropriate output. In between, when the user is lost, then the system will start detecting the user. Here the user is an important part of the system, once the user is lost then you have to follow all the process once again. All Indian sign is taken from the Indian web portal.

3.2 Implementation and Result Comparison

The ISL translator system was implemented in Java and *SimpleOpenNI* API of Java Kinect library. We cached data through *Kinect* IR depth sensor and IR Emitter, we apply nearest matrix matching algorithm, match with stored data and display output in string format as well as audio.

The application requires an Kinect device and computer system, USB Kinect adapter. This application does not require any database provider. We will use a text file for a data storage. For text to sign, we have a video file containing all signs.

Note

1. The video file name must be a sign name
2. The video file extension must be .MP4.

3.3 Nearest Matrix Matching Algorithm

```

String Nearest Matrix Matching (String In_Z, String In_Y String In_Z) {
    While (Data_File != Empty){
        Data_X:=Result Set (X);
        Data_Y:=Result Set (Y);
        Data_Z:=Result Set (Z);
        Integer High:=Low:=Med:=0;
        Token Generation (In_X, In_Y, In_Z, Data_X, Data_Z, Data_Z);
        While (Token) {
            If (In_N-30 <= Data_N && IN_N+30 >= Data_N)
                High++;
            If (In_N-60 <= Data_N && IN_N+60 >= Data_N)
                Med++;
            If (In_N-100 <= Data_N && IN_N+100 >= Data_N)
                Low++;
        }
        Array Temp [] [] [] :=Temp [Result Set No] [High] [Med] [Low];
        High:=Low:=Med:=0;
        Sort (Temp);
        Return Result Set (Temp [0]);
    }
}

```

4 Output

Once you start the application, the home page of the system looks like this.

In this you have three options.

- Sign to Text translation
- Text to Sign translation
- Exit

The image (Fig. 4) is the home page of the system.

Here you have four options, Sign to Text, Text to Sign, about us, and Exit. Once you click on the Sign to Text, you have another four options **Find Sign**, **Insert Sign**, **Text to Sign**, and **Home**.

4.1 Sign to Text

When you click on Find Sign, system checks whether Kinect is connected or not. If connected, then starts to color camera, IR Emitter, IR depth camera of Kinect.



Fig. 4 Home page of the system

The system starts to find user and when the user is found, it starts to trace the user until the user is lost. Now you have to come in the range between the given coordinates, so that you can get maximum accuracy of the system. Your current coordinates display in continually in system, you have to adjust yourself.

When you are in the range of the coordinates, your head is fixed in that position. and then you have to do all signs from the same position.

Now read instructions and follow the given steps.

1. Wait until system detect kinect device, human user, human skeleton.
2. Put your hands together.
3. Get your position and wait until count reaches down to 0.
4. When the system says start, you have to start doing the sign until the system says to stop. If your sign is completed before stop, then you have to stay at the end of you sign position.
5. Wait for output.

Once you complete your sign, the system checks for input, applies nearest matrix matching algorithm on data storage and then finds output of the sign in word format. Whatever output is found will be displayed and given to the Text to Speech converter, which the system will speak.

Note If your output is any symbol, then Text to Speech converter can not speak it.

The image, (Fig. 5), is the output of your inputted sign.

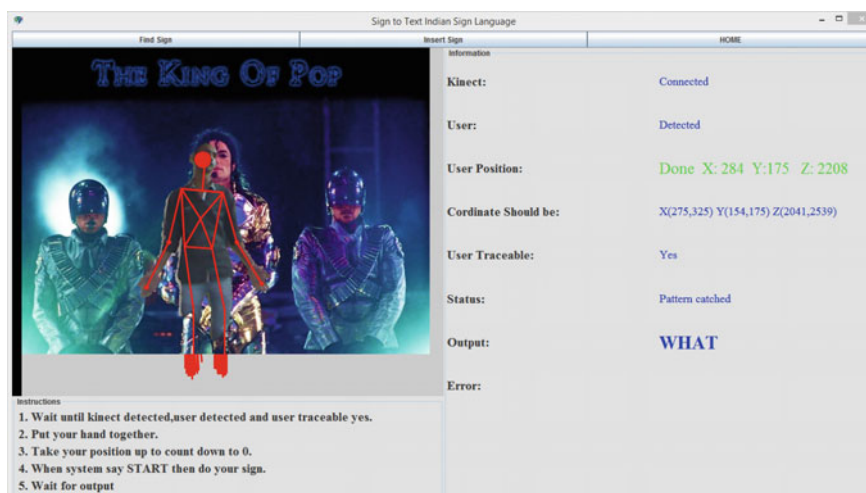


Fig. 5 Output of the sign—Sign to Text module

4.2 Insert Sign

Now you can go to insert sign by click in Insert Sign.

You have to follow the same instruction which you followed in Find Sign module. The only one change is there that you just have to write the name of that sign in the given text box before starting your sign.

Now read the instructions and follow the given steps.

1. Write your sign name in the textbox.
2. Wait until Kinect detect, user detect, and user traceable yes.
3. Put your hands together.
4. Get your position and wait until count reaches down to 0.
5. When the system says start you have to start the sign until the system says to stop. If your sign is completed before stop, then you have to stay at the end of your sign position.

4.3 Text to Sign

Now you can go to Text to Sign module by clicking on Text to Sign button. You can also go to the home page and click on Text to Sign button to reach the same module.

This module provides functionality to normal people so that they can communicate with differently abled people. Once you go to Text to Sign module, it will

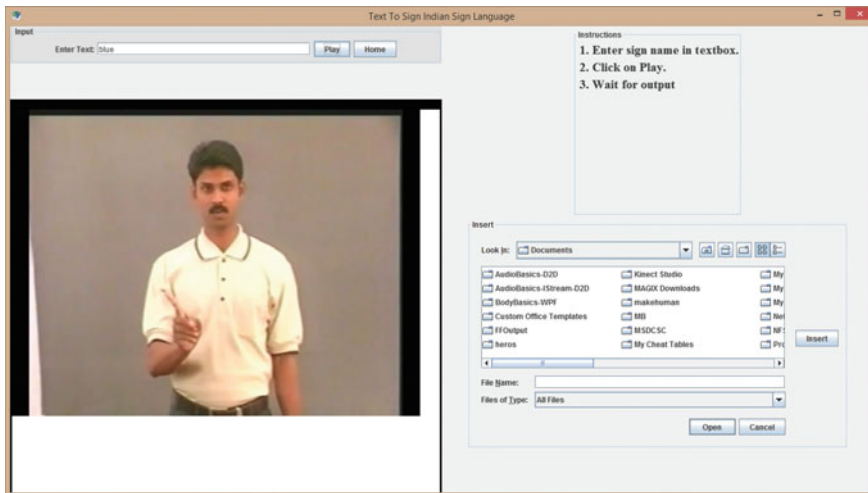


Fig. 6 Text to Text module

play a smiley video in media player with a set of programs. You have to write a sign name in the text box and click on the play button.

The system will find the video for that sign, if found then the media player plays the video. If there is no videos found for that sign name the system says “sign video not found”.

4.4 Insert Video for Sign

In the same module, you can also add new video sign through this module. You have to select your video file and click the submit button.

Note

1. Your file name should be your sign name.
2. Your file extension should be .MP4.

The image in (Fig. 6) is for Text to Sign module.

5 Conclusion

The ISL translator fills the huge communication gap between hearing-impaired community and normal persons. Through ISL system, they can communicate with any person and vice versa so that differently abled people will feel good and happy.

This system can be applied in shopping malls, traveling stations, education systems, healthcare systems, etc.

Using this system, differently able people can easily communicate with normal person and vise versa.

References

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Proceedings of International Conference on ICT for
Sustainable Development

ICT4SD 2015 Volume 2

Satapathy, S.C.; Joshi, A.; Modi, N.; Pathak, N. (Eds.)

2016, XX, 819 p. 409 illus., Softcover

ISBN: 978-981-10-0133-8