Indian Sign Language Recognition Using Leap Motion Technology

[1]Priti B Jagtap, [2]Pranoti S Shinde, [3]Shubham T Patil, [4]Vishal N Tank, [5]Mohan A Chimanna

[1,2,3,4] Students, [5]Professor,
[1]Deptartment of Computer Engineering,
[1]SPPU, Dr. D.Y.Patil College of Engg. & Innovation, Varale, Talegaon, Pune, Maharashtra, India.

***Abstract*: The Leap Motion is the procedure of nice grained gesture reorganization and Hand Tracking. The Leap Motion is a cutting-edge 3D motion capture system. It is designed especially for hand and finger tracking with precision up to 0.01mm. The end result implements in promising in their contexts however requires a number of modifications due to its bodily as properly as logical challenges to be overcome. The gestural implementation of this system is an advantage by which various applications to be accessed. This technology is useful in many applications such as designing, modeling, musical interaction and expression. The leap motion device has two built-in cameras and three infrared sensors that can record 3D images or hand movements.**

***Keywords: Gesture reorganization, Grained gesture, Hand Tracking, Designing, Modeling, Musical interactions*.**

I. INTRODUCTION:

Leap Motion is a technology fit to revolutionize the daily operations computing. Leap Motion is a 3D motion sensing technology perfect for use for various purposes of input. The technology is encapsulated in a small device comparable to the size of a USB flash drive. The controller is connected via a USB cord to a computer and utilized using free software found online.

Due to its simplistic design, Leap Motion technology would be easy to integrate with the existing technology. While it would be simple to implement, it would drastically improve the current capabilities of the input devices.

Have you ever wondered what it would be like if you could simulate a surgery for students using your very own hands but not incurring the cost of surgical equipment and supplies? Or even you may have not imagined ever of checking out all the modules of a machine just by simulating its design and not paying the cost if the damage caused. And the major focus is that all you will be able to do by your own hands. This is where the Leap Motion technology comes into play. Simply by using 3 infrared LEDs and cameras, the device pinpoints the location of not only all 10 fingers, but also the joints and palms of the hands to 1/100th of a millimeter. The location and movement of the hand is then tracked at 200 frames per second and relayed to the attached computing device. The user can move their hands within 8 cubic feet of the device in up and down, side to side, and in and out motions likewise in real life.

II. LITERATURE REVIEW:

Researchers have employed tools including web cameras, instrumented gloves, depth cameras, and Kinect sensors to collect hand signals. In this study, a method for recognizing Indian Sign Language (ISL) employing both hands and a Leap Motion sensor is built. This sensor resolves the main problems in a real-time environment, such as occlusion, lighting, and background. The 3D finger location is provided by the jump motion sensor, which records the hand gesture (X, Y, Z axis values). Based on Euclidean distance and Cosine similarity, the positional information of the five finger tips and the middle of the palm for both hands is used to identify sign posture.

In this study, the flex sensors and accelerometer will be used to control gestures represented by symbols from Indian Sign Language. Rotation, angle tilt, and direction shifts are movements that are incorporated into gesture representation. To learn about their dynamics, the accelerometer and flex sensor are put over the data glove's fingers and wrists, respectively. The microcontroller will then suggest these voltage signals to the voice module, where the words voice outputs are saved and played back equivalent to each word values to produce the proper voice words with the speaker's assistance.

A promising application that bridges the communication gap between hearing and deaf persons is sign language recognition. It must exist in a free atmosphere in order to be used in practice. If one of the control assumptions is broken, previous built systems suffer from the controlled environment limitation. The recognition's accuracy falls off drastically. To find and fix anticipated mistakes brought on by the recognition system, a post-processing module based on NLP principles is required. a semantic-orientation technique that is more precise, especially for domain-specific sign language recognition mistake detection and repair, and can correct errors at both the semantic and lexical levels.

III. METHODOLOGY:

i. Overview: The technology specifies the use of Leap Motion controller for various fundamental applications of computing. The Leap Motion sensor is the core of the Leap Motion Controller. This senses the input gesture provided even by the conventional input methods. The gesture pattern for the given input is matched accordingly the gestures as applied and the system performs the desired

work accordingly. Simple gestures like swiping, pinching, sliding, clicking, pointing, dragging, dropping etc. are included in such gesture reorganization technology.

ii. System Analysis: The existing systems include various related technologies that are used for these prospects. Like camera input using technologies. For examples: When a user has to use camera it only gives 2D overview.

iii. Disadvantages: The existing systems of the inputs are having some disadvantages due to which some of the users may feel inconvenience of using it just because of some considerable aspects like time, reliability, methods of input, and other activities. This overcomes the invention of the technology like Leap Motion.

iv. Proposed System: This controller is able to recognize the position and movement of the user's hand. This gives user a functionality to give an input to the system using gestures. The controller detects the position and motion of the user hand with a precision of 0.01mm within an eight cubic foot volume of the space. This means every finger's motion can be detected above the device within a space the size of 33 inch screen in a square box. The controller can track any movement such as pinch, wave or any other motion which user can make by using fingers, hands or any other small devices like pen, pencils etc. The actual Leap Motion Technology computer software then translates these motions into actual commands used for the further computing purpose.

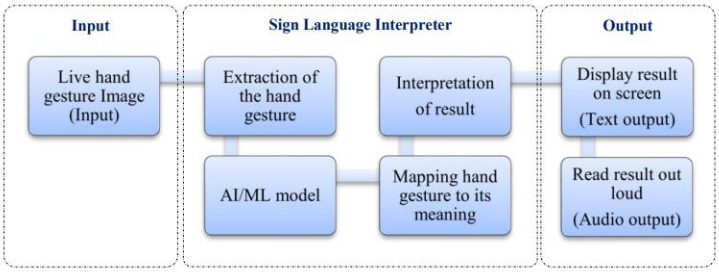

Fig 1: Basic Working Model

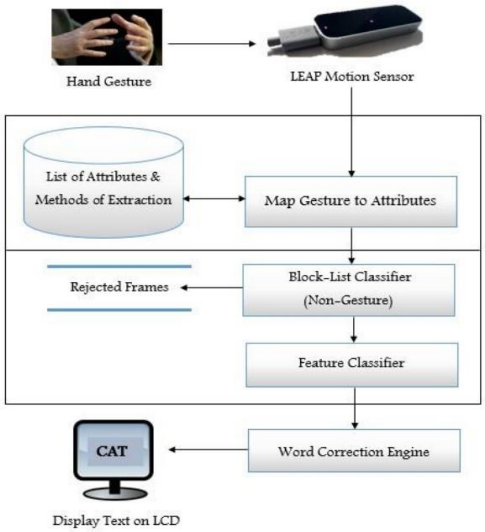

Fig 2: Block Diagram

- **Hand Gestures:** For recognizing any sign language a gesture is important. In this model we are going to identify the Indian sign language.
- **Leap Motion Sensor:** Leap motion sensor is a small device that can be connected to a computer using a USB. It determines the position of predefined objects in a limited space in real time.
- **List of Attributes and Methods of Extraction:** All the attributes related to fingers, palm and which are supported by the Leap motion API are stored into the database.
- Attributes are used to get the raw values from the captured frames.
- **Map Gestures to Attributes:** Each frame is recognized according to values of attributes and methods of extraction for gesture or non-gesture frame.
- **Block-List Classifier:** Block-list classifier isolates the non-gesture frames using Random Forest (RF) classifier.
- **Feature Classifier:** Feature classifier uses RF classifier for recognition of correct alphabet.
- It is responsible for converting each frame to its equivalent character.
- **Word Correction Engine:** All corrected alphabet frames are fed to the word correction engine module.

- From the recognized alphabet frames we need to create a meaningful word.
- **Display text on LCD:** Created meaningful word is then displayed in the Computer screen.

IV. FACILITIES REQUIRED FOR PROPOSED SYSTEM:

1) Software: Leap Motion software and airspace.
Python (programming language).
Any operating system (windows, Linux, ubuntu).
2) Hardware: 1 GHz or faster Pentium class PC.
A minimum of 2 GB of RAM and a minimum of 1 GB of free disk space is also required.
LEAP Motion Controller.
USB 2.0 port

V. APPLICATIONS:

1) A new technique for input used for computers.
2) Can be used as an input device for multiple purposes such as Education, Medical Sciences, Simulation, and Gaming etc.
3) Revolutionary Input Method for Gesture Recognition which will be helpful for people who cannot speak.

VI. CONCLUSION:

Indian Sign Language recognition is essential for the deaf and dumb people to communicate with other people. Leap motion controller is used to recognize the Indian sign language. Leap motion controller is 3D non-contact motion sensor which detects and tracks hands, finger, bones and finger like objects reporting discrete position and motion. It has some advantages like robustness, requires less memory, fast processing. It does not require any specific background and environmental conditions.

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